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PHASOR PHYSICAL ANALYSIS OF SOLIDS OF REVOLUTION, USER MANUAL.(U)
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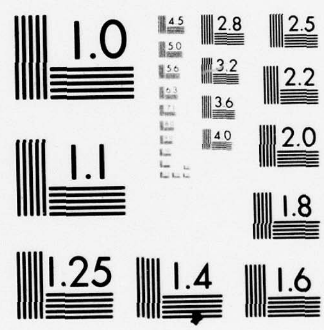

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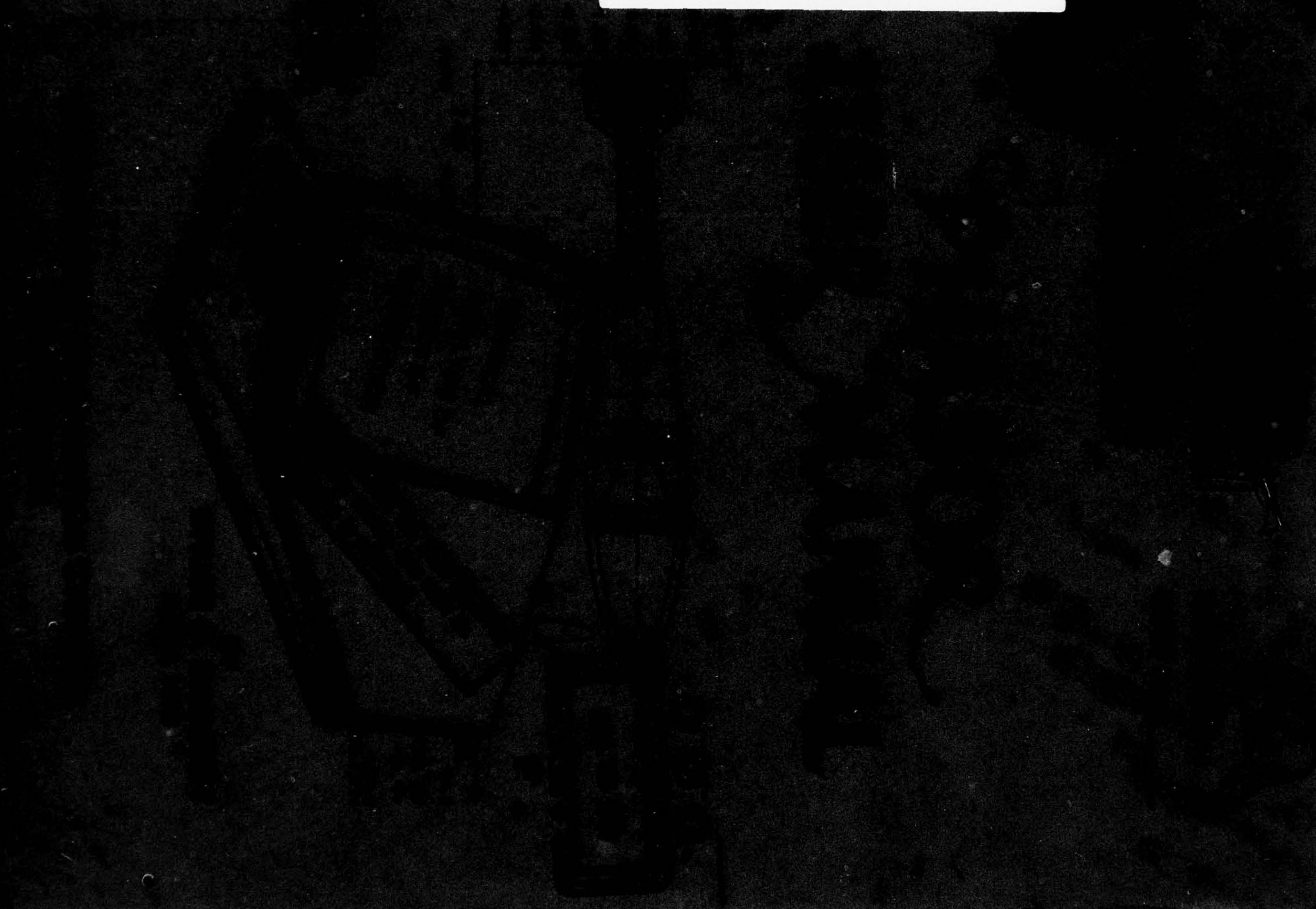

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6 # PHASOR,

PHysical Analysis of Solids Of Revolution, User Manual.

by

10 **BRUCE D. CARBREY**

11 **APR[redacted]78**

12 318p.

MANAGEMENT INFORMATION SYSTEMS DIRECTORATE
SCIENTIFIC AND ENGINEERING APPLICATIONS DIVISION

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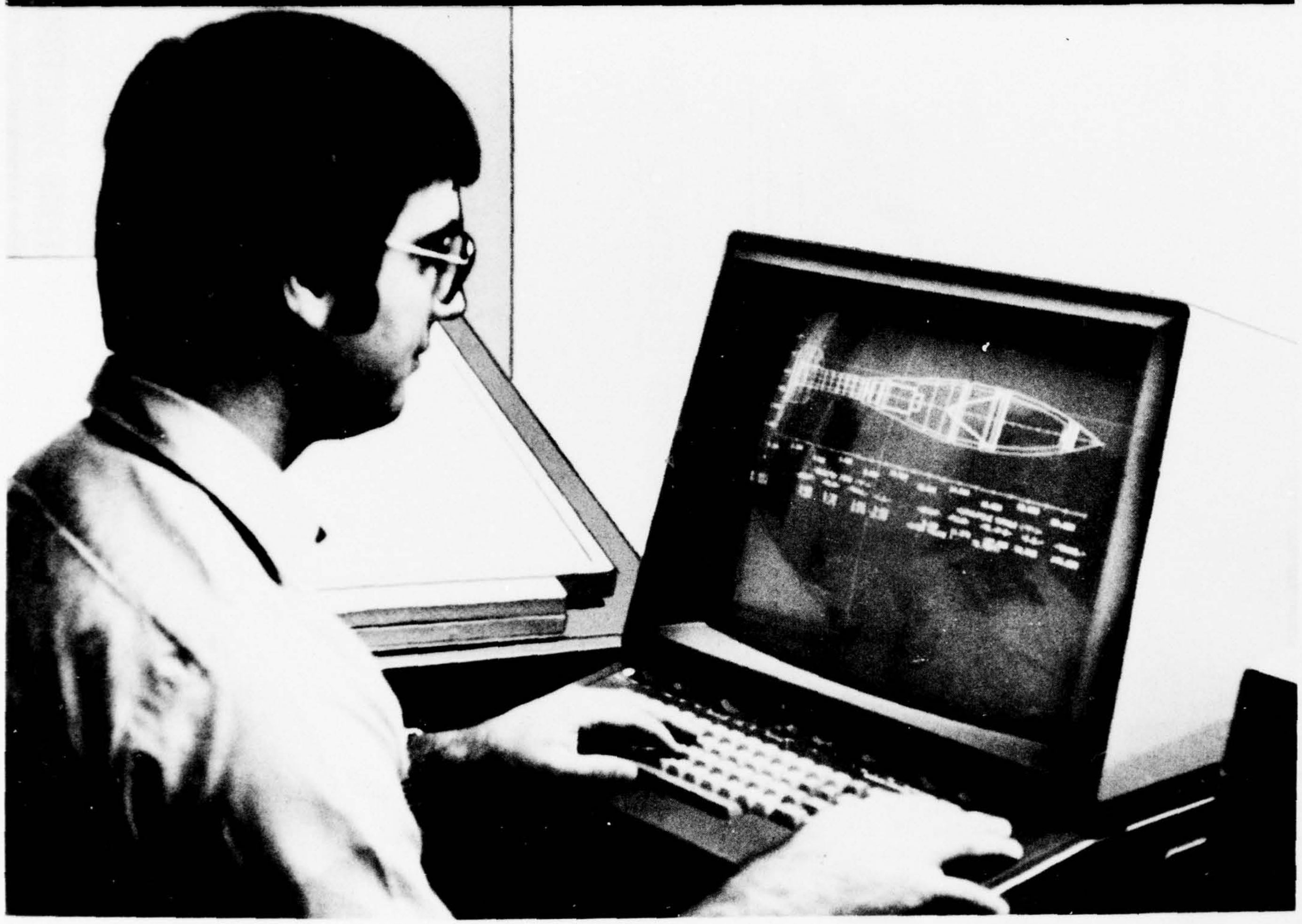
PHASOR



ABSTRACT

PHASOR (PHysical Analysis of Solids Of Revolution) is a large interactive graphics computer program for computing the weight, center of gravity, volume, and moments of inertia of axisymmetric bodies such as projectiles, rockets, bombs, etc. A Tektronix 4014 graphic terminal is required to run PHASOR on the CDC 6500/6600 computer at ARRADCOM, Dover, New Jersey. The program includes many flexible capabilities, including file generation/modification, a graphic text editor, tablet input, and output on disk, punch, plotter, CRT, and line printer.

ASSUMPTIONS

No knowledge of any computer programming language is needed to use PHASOR. Familiarity with the CDC SCOPE/INTERCOM system, while not essential, is helpful. Users already familiar with the WEIGHT or PROMS computer programs will be able to quickly adapt to PHASOR usage, but no prior exposure to these programs is assumed.

DISCLAIMER

ACKNOWLEDGEMENTS

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Richard Sitnik and Howard Corneilson for programming advice;
Bill Bolte for editing and proof reading;
Sylvia Polanski for many, many hours of typing;
Robert Isakower for encouraging creative programming and having the patience to wait for it to come to fruition.

TO THE READER

Please do not let the size of this manual intimidate you. This manual is intended to serve as a comprehensive reference; however, only a small subset of the information given is needed for casual operation. For an initial introduction, it is suggested you read Chapter 2 and skim Chapters 1, 3 and 4. Then, after gaining some familiarity with PHASOR Operation, you will probably want to familiarize yourself with the many capabilities and options covered in the remaining chapters. A topical index is provided to facilitate use of the manual for reference purposes.

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APPENDICIES

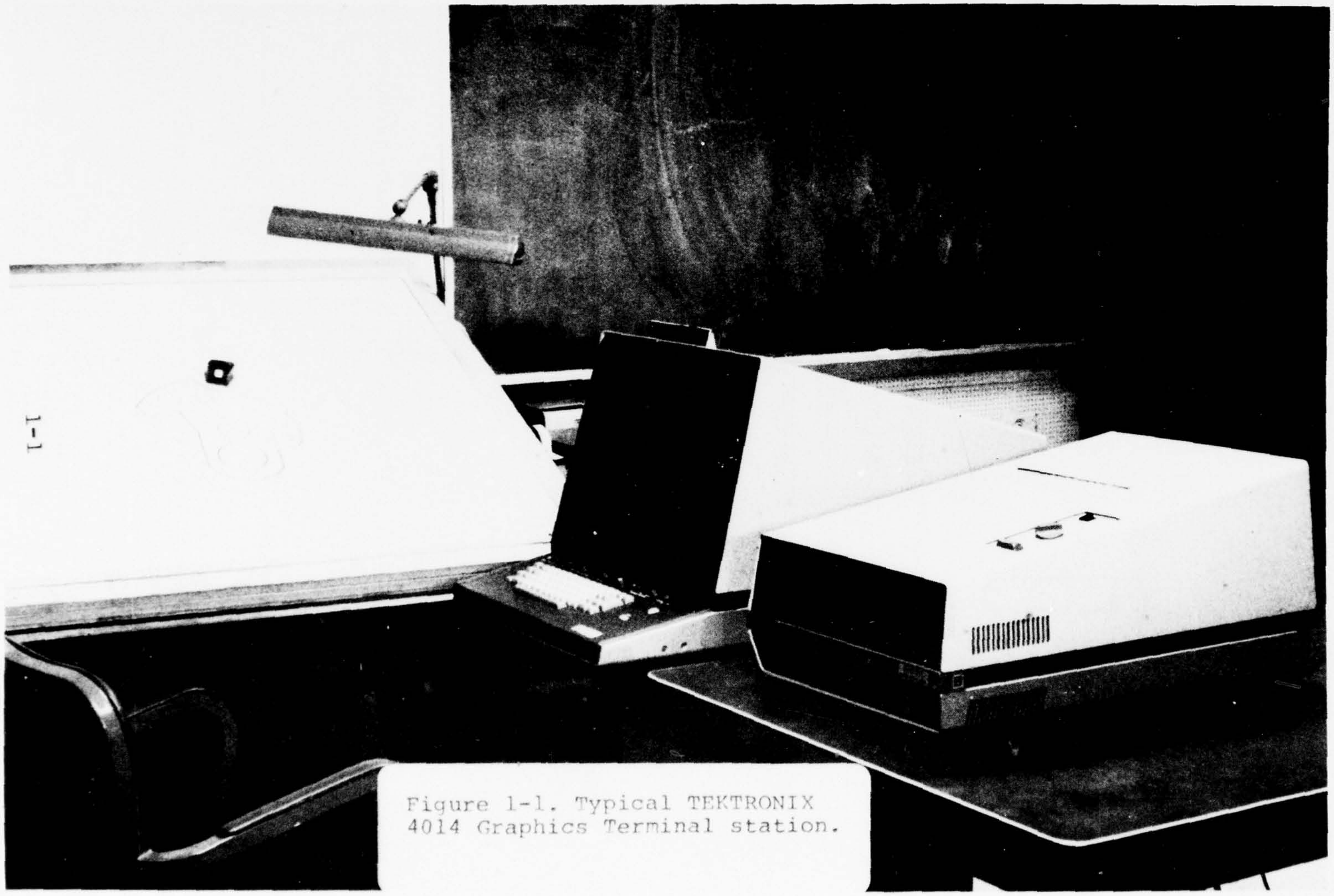


Figure 1-1. Typical TEKTRONIX 4014 Graphics Terminal station.

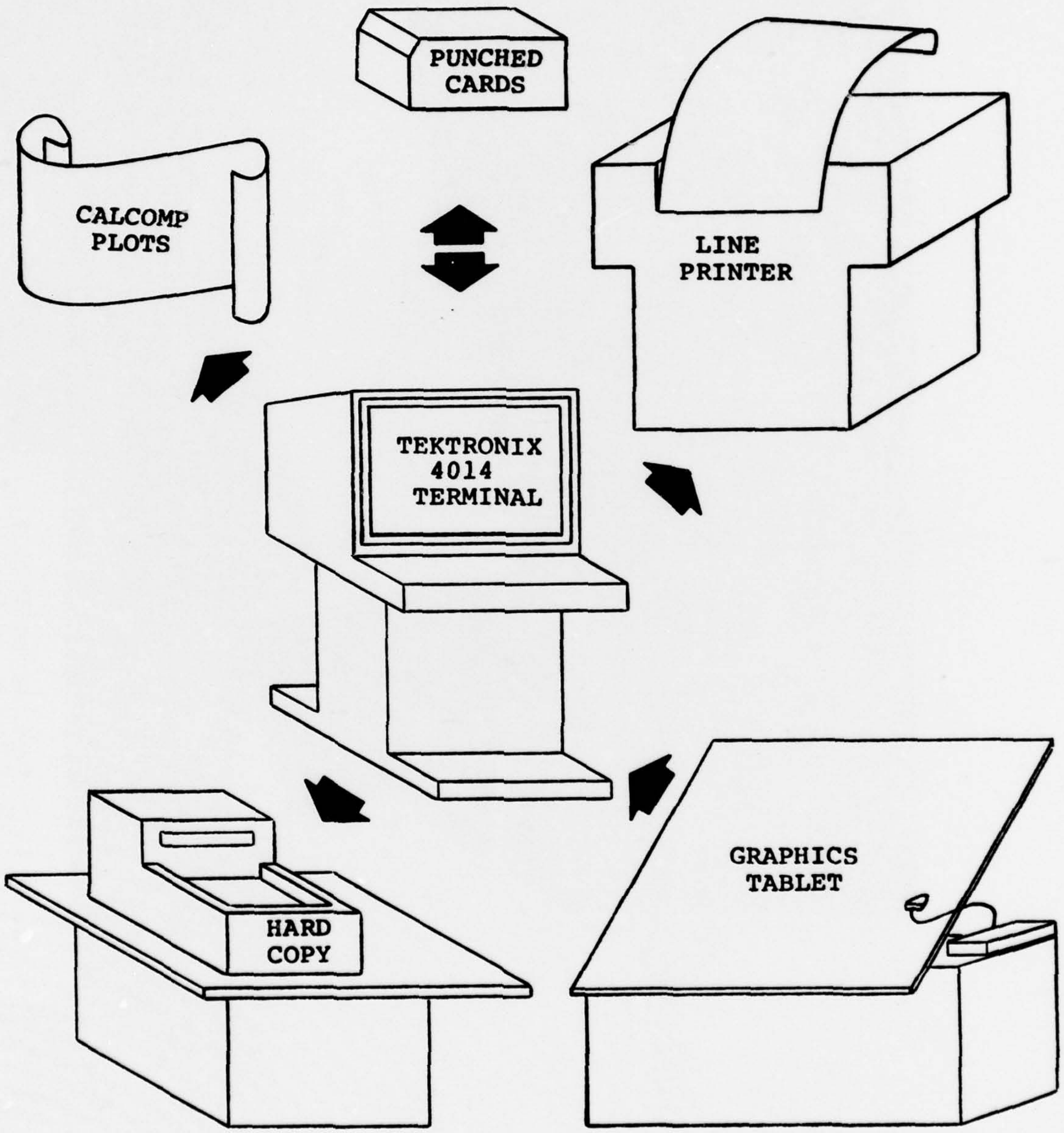


Figure 1-2. PHASOR provides unusually versatile input-output capabilities.

1. INTRODUCTION

What is PHASOR?

PHASOR (PHysical Analysis of Solids Of Revolution) is a large interactive graphics computer program for computing the physical properties of axisymmetric bodies such as ballistic projectiles, rockets, fuzes, etc. The program is explicitly intended to be run on the CDC 6000 series computer at ARRADCOM, Dover from remote TEKTRONIX 4014 terminals.

The most distinguishing characteristic of PHASOR is its flexibility. The user may utilize any or all of the following input methods, alone or in combination:

1. Punching free-format descriptive data cards.
2. Using existing WEIGHT, or PROMS program decks.
3. Creating or editing free-format card images interactively.
4. Digitizing sketches or drawings directly, without punching any cards.
5. Attaching, modifying, or saving stored permanent file data bases.
6. "Sketching" directly on the terminal screen using the graphic cursor.

The user may freely select output from the program in any or all of the following forms:

1. Printout from line-printer of totals, data bases, sub-totals, chronology.
2. Punched decks of cards.
3. Displayed drawings of all or part of shell, with total and/or individual properties, in a variety of formats.
4. 8x10 hardcopy plots/printout suitable for reports, in 30 seconds, from hardcopy unit.
5. Calcomp plots of all or part of shell in a variety of formats and sizes determined by the user.
6. Permanent file data base retained in mass storage for future recall.

PHASOR can compute the weight, center of gravity, polar and transverse moments of inertia, and outer volume for any axisymmetric shell, which may also have fins.

1.1

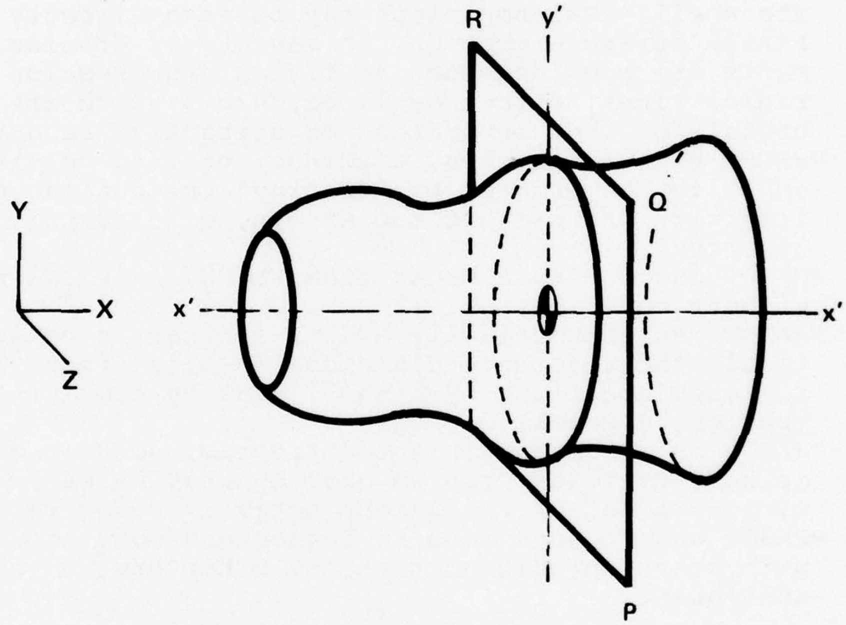
Why use PHASOR?

This is certainly a valid question to ask since there are already several excellent computer programs available for analysis of axisymmetric bodies, notably the popular WEIGHT program, written by Sid Kravitz et al, and PROMS, by Bill Bolte (for the IGS 274 system in Building 353). So why, you might ask, should one go to the trouble of learning a new program when proven programs already exist? The answer is that PHASOR has capabilities and features that far exceed those of its predecessors, some of which are described quickly below:

1. PHASOR is the only interactive program for remote terminals.
2. PHASOR is designed from the ground up for interactive use; it is not just a converted BATCH program.
3. PHASOR can take decks of any size. There is virtually no limit to the complexity of the item which can be analyzed.
4. PHASOR can determine the outer volume of a shell automatically without user having to designate outside "items".
5. PHASOR uses free format data cards. Data does not have to be punched in certain columns. Numeric data may be written with or without a decimal point.
6. PHASOR does not require user to count data cards of each type; in fact, items of the same type need not even be grouped together.
7. PHASOR is extremely resistant to "bombing" due to user errors.
8. PHASOR provides an easy format for describing ogives so that the user does not need to know the center.
9. PHASOR includes an efficient EDITOR as an integral part of the program which allows the user to alter cards in his deck by merely "pointing at" them with the cursor. Edit actions include DELETE CARD OR GROUP OF CARDS, INSERT CARD OR GROUP OF CARDS, REPLACE CARD OR GROUP OF CARDS, REPLACE CHARACTER STRING ON CARD, MOVE CARD OR GROUP OF CARDS, COPY CARD OR GROUP OF CARDS, and more. A maximum of three keystokes are needed to perform any edit action; most need only one keystroke.

10. PHASOR provides a complete file system as an integral part of the program. Files may be created and named at will, and may be CATALOGUED for permanent retention.
11. PHASOR provides comprehensive graphic capabilities. Automatic scaling and scale annotation of axis is provided and automatic zooming to view any portion of the shell. Calcomp plots may be made directly from PHASOR during execution. A variety of drawing enhancements are provided such as titles, suppression of radial lines, arrowhead lines, etc., which are very useful for the preparation of attractive reports.
12. PHASOR allows sketches, drawings, etc. to be directly input to the program by "tracing" the outline of the item with the graphic tablet pen, with surprising accuracy.
13. PHASOR can run data decks from WEIGHT or PROMS programs without modification.
14. PHASOR can automatically add or subtract a constant to all the reference distances for its items, making for easy modelling of a shell made by combining previously modelled parts.
15. PHASOR is a command oriented program, so user can quickly tell the program exactly what he wants done without a lot of extraneous activity being required.
16. PHASOR can produce results faster and more economically with better precision that any other program currently available.

DEFINITIONS OF MOMENTS OF INERTIA FOR THE ENTIRE SHELL



$P \equiv$ "POLAR" SECOND MOMENT WITH RESPECT TO THE AXIS OF SYMMETRY, x' x'

$T \equiv$ "TRANSVERSE" $\equiv$ SECOND MOMENT WITH RESPECT TO AN AXIS PERPENDICULAR TO THE AXIS OF SYMMETRY, PASSING THROUGH THE CG, SUCH AS y' y'

$T' \equiv$ "PLANAR TRANSVERSE" $= T - \frac{P}{2} \equiv$ SECOND MOMENT WITH RESPECT TO A PLANE PQR, PERPENDICULAR TO THE AXIS OF SYMMETRY AND PASSING THROUGH THE CG

Figure 1-3. Definitions of computed results for the entire model.

1.2 DEFINITIONS OF COMPUTED RESULTS

The mathematical derivations for the computed results determined by PHASOR are given in Appendix F. This section provides a basic concept of the meanings of the computed results.

PHASOR will provide the following properties for the entire shell:

WEIGHT of the shell in force units, normally pounds.

CENTER OF GRAVITY, C.G., in length units along the axis of symmetry from the reference axis, normally in inches.

POLAR MOMENT OF INERTIA, P, the second moment with respect to the axis of symmetry, normally in pound-inches squared.

TRANSVERSE MOMENT OF INERTIA, T, the second moment with respect to an axis perpendicular to the axis of symmetry, passing through the C.G., normally in pounds-inches-squared.

PLANAR TRANSVERSE MOMENT OF INERTIA, T', the second moment with respect to a plane perpendicular to the axis of symmetry and passing through the C.G..

OUTER VOLUME OF THE SHELL, V, the displaced volume for the entire shell, normally in cubic inches. Outer volume computation limitations are discussed in section 11.

Note: It can be shown that for an axially symmetric body,

$$T' = T - P/2$$

Refer to figure 1-3 for definition clarification.

Note that any consistent system of units may be used, so that although pound/inch units have been used traditionally, metric measure is also acceptable to PHASOR.

1.3 NOTATION USED IN THIS MANUAL

The following notation is used in the examples throughout this manual:

Items shown in all UPPER CASE letters are keywords with pre-defined meanings, and are shown exactly as they must be entered.

Items shown in lower case letters are names representing quantities or words which must be supplied by the user.

Items which are underlined in examples are typed by the user at the terminal. All items not underlined are displayed by the computer.

A single upper case letter with a circle around it represents a graphic input keystroke, or GINK, which means that only the indicated character needs to be depressed on the TEKTRONIX terminal keyboard; the carriage RETURN key should not be depressed.

Examples:

//PUNCH

For this case, the computer displayed "//", and user typed "PUNCH", followed by a carriage return.

//SAVE,lfn

For this case, the computer displayed "//", and user typed in "SAVE", followed by another word represented by lfn. The actual characters typed for lfn is not specified, and could be, for instance, "MYFILE", or "AA" or "DATA23", or any other legal name.

T

For this case, user simply depressed the T key, and did not depress the carriage return, because the circle indicates that the T is a GINK and will be acted upon immediately by PHASOR without waiting for a carriage return.

2. GETTING STARTED.

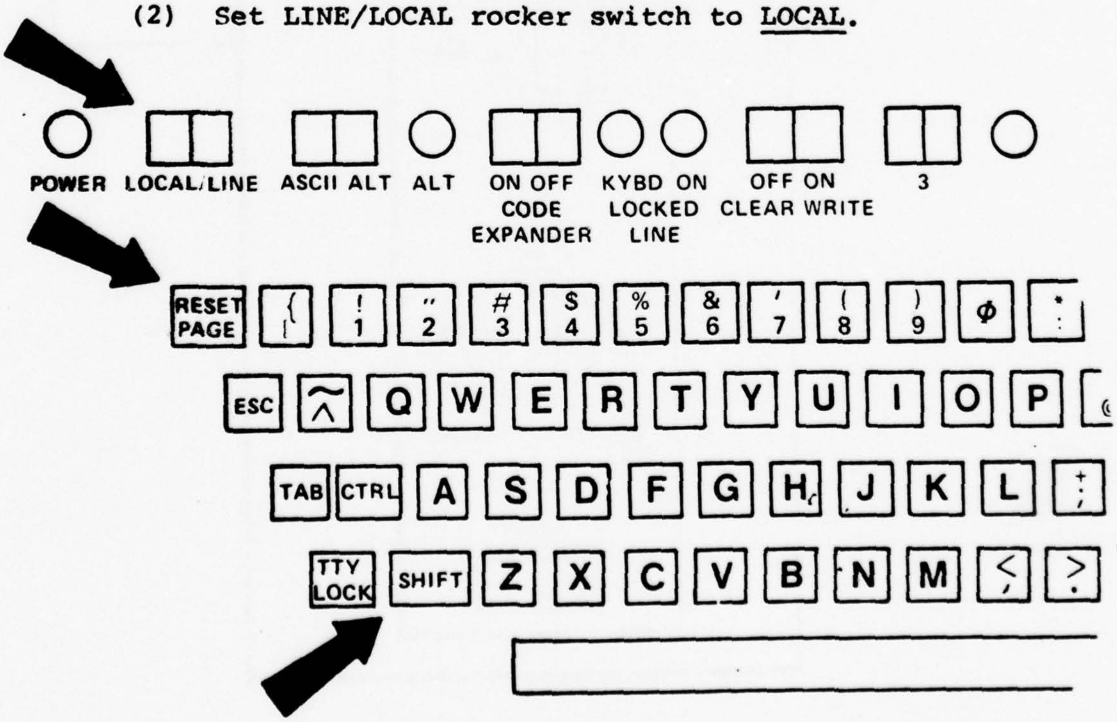
The best way for you to learn how to use PHASOR is to try it. So if you will take this manual in hand, and find a TEKTRONIX 4014 terminal, you can learn how to use PHASOR right now. Even if you have never used the 4014 before, you will be able to try it. All you need is a user ID, a password, and the computer's phone number to gain access to the computer. If you don't have an ID, you can get one by calling Bill Stein at Autovon 880-6303.

The following discussion will be developed slowly, one step at a time so you shouldn't have any problem; but if you do, skip to Appendix A which contains a trouble-shooting guide. The following discussion assumes standard 300 baud operation.

2.1 LOGGING IN.

(1) Power up the 4014 by turning on the power switch located about 10 inches from the floor on the pedestal base. If the 4014 is equipped with a model 4631 Hardcopy unit (figure 2-1) power it up also.

(2) Set LINE/LOCAL rocker switch to LOCAL.



(3) Simultaneously depress these two keys: SHIFT, and RESET PAGE.

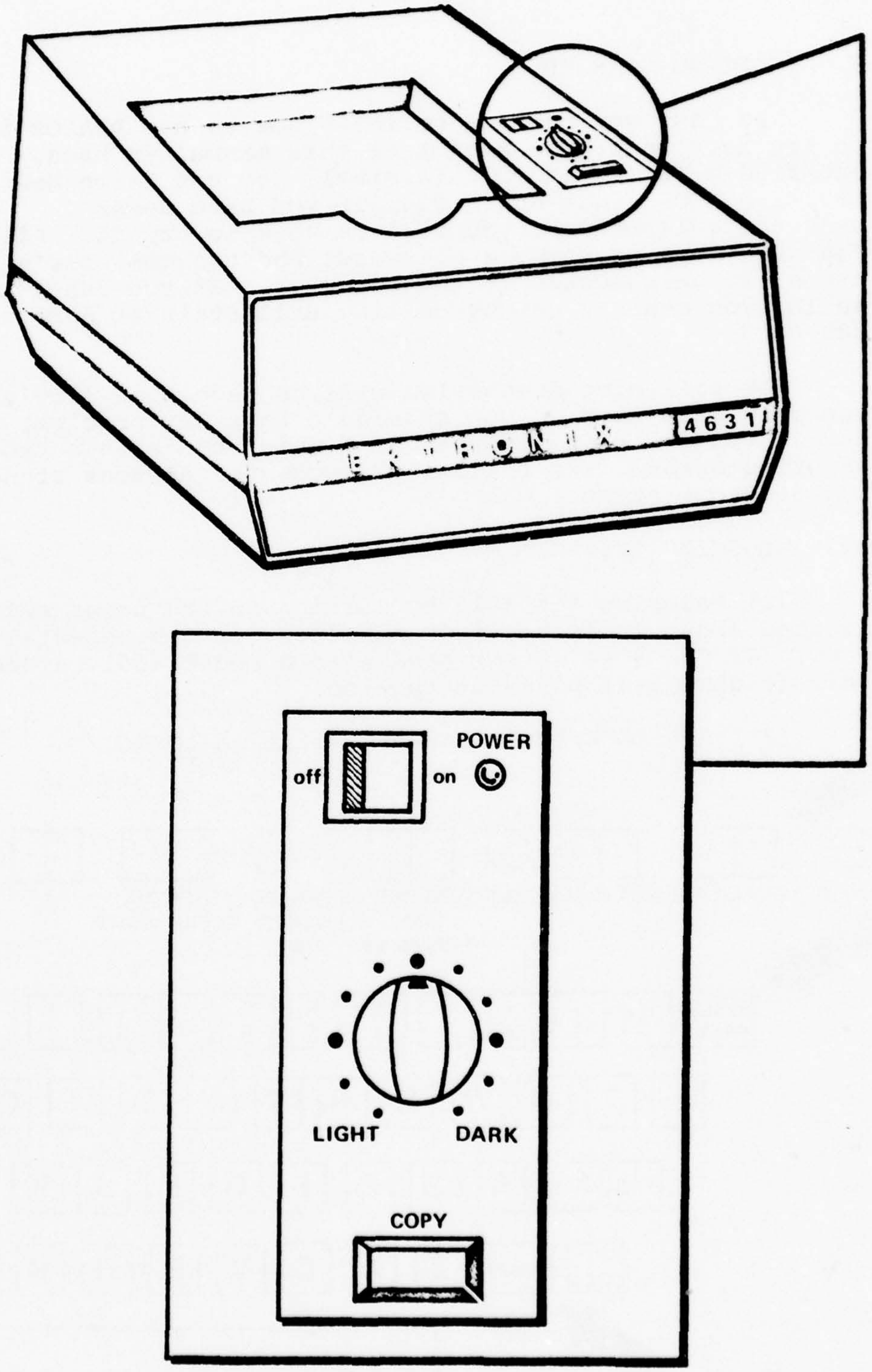
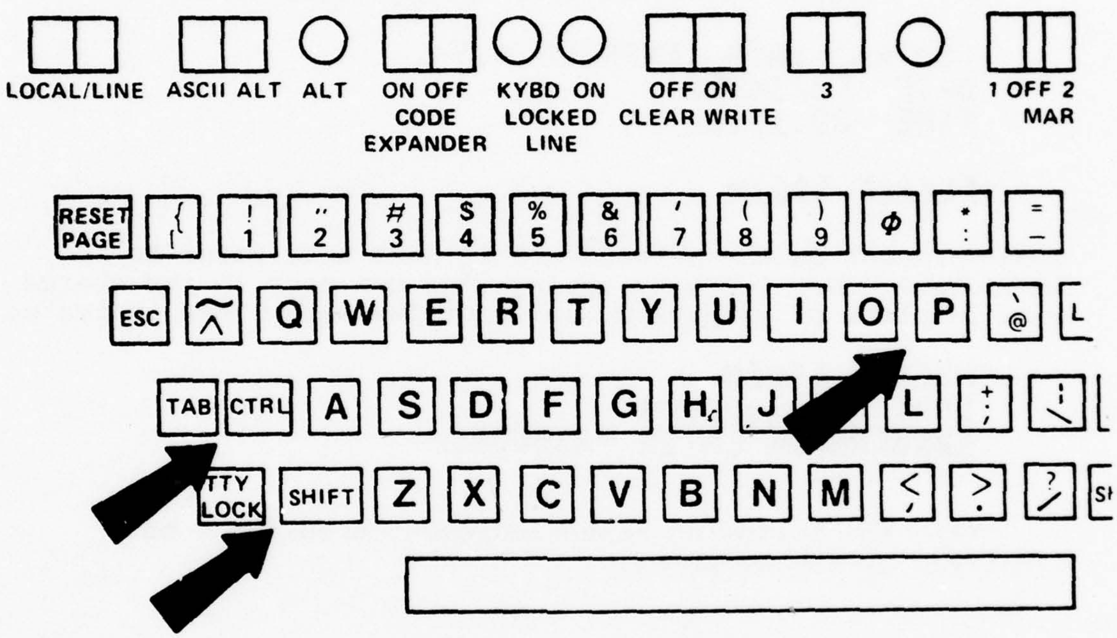


Figure 2-1. TEKTRONIX 4631
Hardcopier produces dry copies
of the screen image in 15 secs.

(4) Depress CNTRL, then simultaneously depress these two keys: SHIFT, P. The terminal is now ready to communicate with the computer.



(5) Insure that TTY LOCK is in the depressed position; then set the LINE/LOCAL rocker switch to LINE.

(6) Pick up the telephone receiver from the data set, depress the TALK button on the data set, and then dial the appropriate number selected from the list of 300 baud phone numbers which was given to you along with your password.

(7) After one or two rings, an audible whistling tone should be heard. Depress the <u>DATA</u> button on the data set, and hang up. The computer and terminal should now be linked together.

(8) After a few seconds, a message similar to,

```
CONTROL DATA INTERCOM 4.5
DATE  03/14/78
TIME  09.15.52.

PLEASE LOGIN
```

should appear on the screen. If it does not, refer to Appendix A. Now LOGIN by typing your own user ID and charge code in place of xxxyyyzzz, and your password where indicated.

```
PLEASE LOGIN
LOGIN,Lxxxyyyzzz
[redacted] ENTER PASSWORD-
```

(9) The following acknowledgement should now be displayed by the computer:

```
04/03/78   LOGGED IN AT  10.55.52.
           WITH USER-ID DH
           EQUIP/PORT 40/005
COMMAND-
```

(10) The computer is now yours to command. Carefully type in the <u>underlined</u> instructions exactly as shown below; the portions not underlined will be displayed by the computer.

```
COMMAND-ETL,100.

COMMAND- BEGIN,PHASOR,BR/CARBREY.
```

(11) After a pause, the screen will "flash" momentarily and erase, and two slashes will appear at the upper left hand corner of the screen.

```
PHASOR 1.0 REV. D
//
```

These two slashes are a prompt to indicate that PHASOR is in the DIRECTIVE MODE and ready for you to enter a directive. Whenever two slashes appear on the screen, PHASOR is waiting for you to type in a DIRECTIVE.

If you have used the EDITOR utility before, you should think of these two slashes as being similar to the two dots that prompt you in EDITOR. In fact, many of the commands you might enter from EDITOR can also be used in PHASOR as directives. For now, though, we are not going to discuss what DIRECTIVES are available, but rather just copy some sample DIRECTIVES from this manual to get the hang of it.

Carefully type in the underlined portions, exactly as shown below. Later we shall learn how to use these directives; for now it is sufficient for you to know that we wish to fetch a data base which has already been stored away for you to use.

```
PHASOR 1.0 REV. D
//ATTACH,DATA1,SAMPLEDATA,CY=1,ID=CARBREY.
//READ,DATA1
PHASOR READS DATA SET    1 OF FILE DATA1
   25 CARD IMAGES READ.
//DRAW,VIEW=FULL,RADIAL=OFF
```

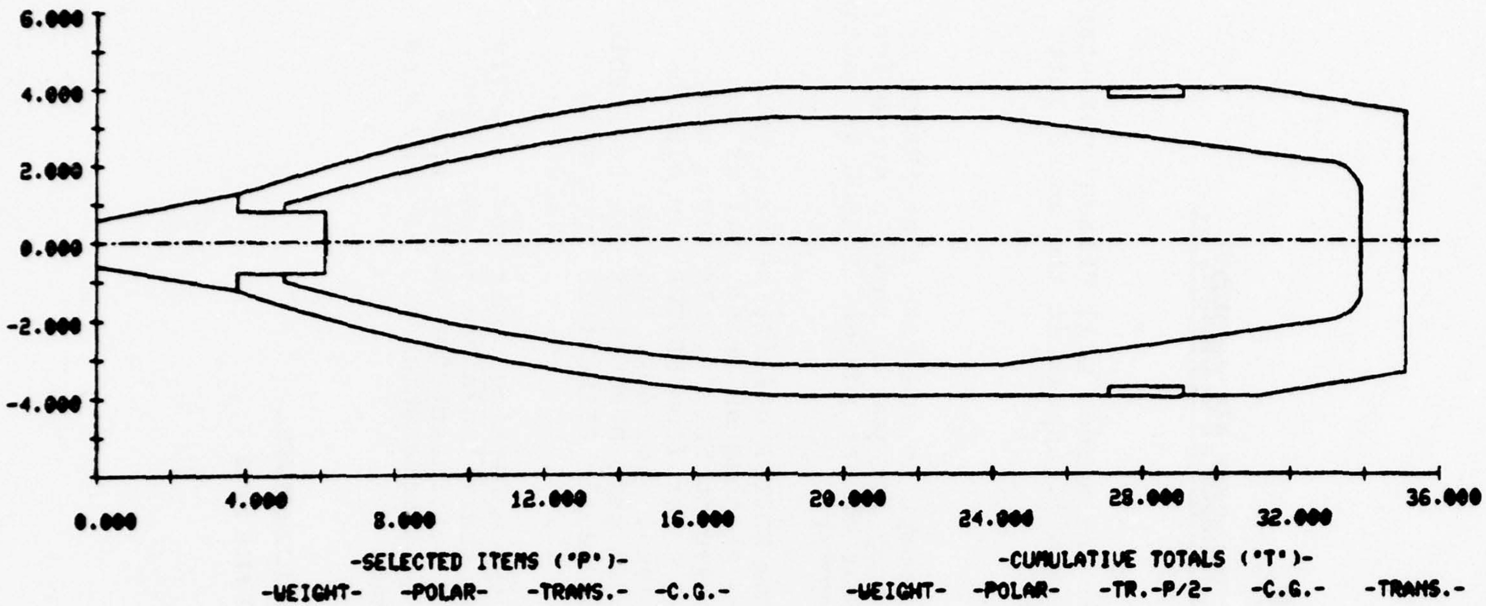


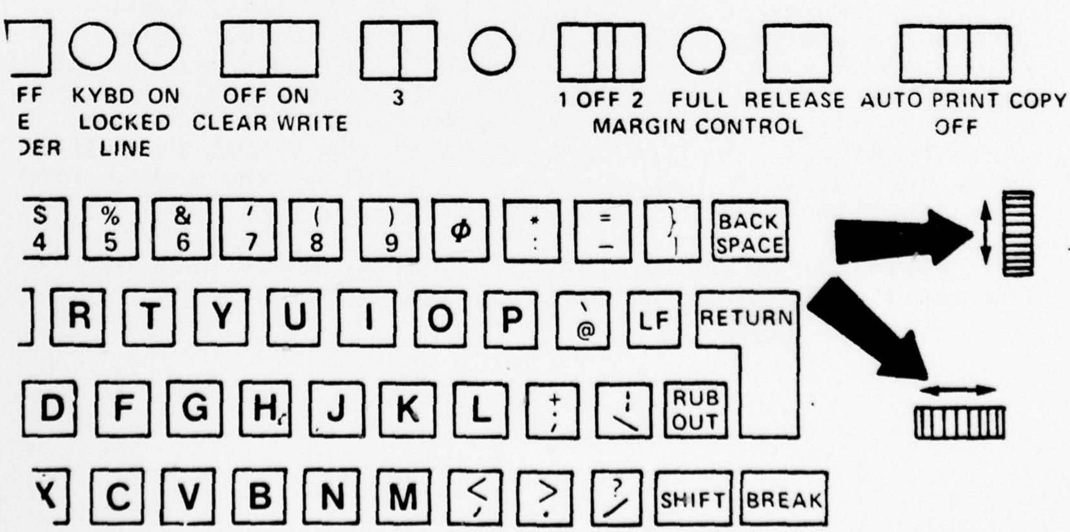
Figure 2-2. DRAW mode display of sample projectile.

The informative message, "25 CARD IMAGES READ" indicates that PHASOR has read an existing data base which describes a projectile on 25 punched data cards. Later you will learn the form these punched cards take. For now, be content to know that they describe the physical dimensions of the shell and its materials.

The last directive tells PHASOR to draw the projectile, and furthermore that we wish to see the whole shell, with radial lines not drawn. The portion of the directive which reads "VIEW=FULL, RADIAL=OFF" specifies optional parameters. Most directives have one or more options which the user can specify if he wishes, in order to control the type of display, method of solution, etc. The options available and their uses will be discussed later.

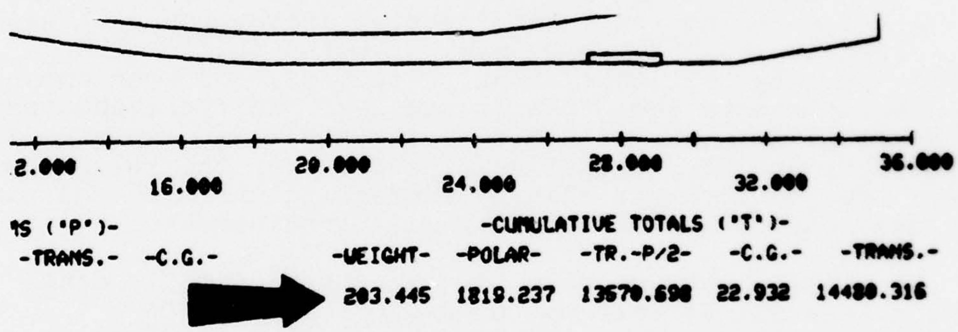
After entering the last directive above, you will see the screen erase, and PHASOR will draw the shell. The drawing process will take about 30 seconds, and when complete, the display should look like figure 2-2. In the event that the terminal stops drawing before the shell is complete, it is probably due to a transmission error over the telephone lines. You may correct this by depressing the space bar and carriage return, and the display will continue.

You will always be able to tell when PHASOR is done drawing, because it will put up a <u>CROSSHAIR CURSOR</u> somewhere on the screen. The Graphic CURSOR is the pair of lines, one horizontal and one vertical, which can be maneuvered by the thumbwheels. Try turning the thumbwheels to see the effect on the cursor.



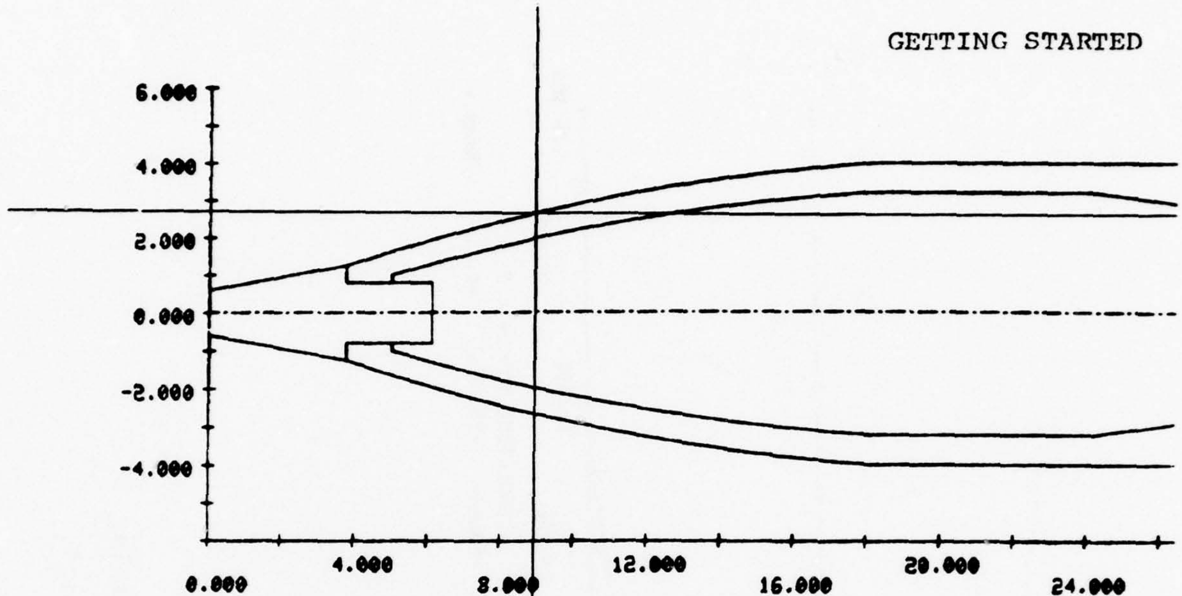
The CURSOR is essential to PHASOR operation. By using the thumbwheels, you can position the intersection of the crosshairs over various parts of the display. This enables you to "point at" different parts of the display, and PHASOR will know where you are "pointing". Each of the keys on the keyboard represents a certain command to PHASOR. By striking the appropriate key, you can command PHASOR to take a particular action with the part of the screen image you are pointing at.

(12) In DRAW mode, the letter T is used to command PHASOR to display the total properties of the shell. Position the cursor anywhere on the screen, and depress the T key. Do not depress the carriage return. After a few seconds, PHASOR should display the weight, center of gravity, and moments of inertia of the pictured shell:



(13) On the display, the dash-dot centerline drawn horizontally is the axis of symmetry of the shell. The display shows a cross-sectional view of the shell taken by passing a plane through the axis of symmetry. This longitudinal axis is designated the X axis, and the tic marks and tic labels which run from left to right are the X axis units, usually inches. The solid vertical axis with tic marks running at vertical intervals is the Y axis or radial axis, and the units are measured in terms of the radius from the centerline.

Position the cursor carefully on the upper half of the shell at exactly the position shown below:



	-SELECTED ITEMS ('P')-				-CUMULA	
	-WEIGHT-	-POLAR-	-TRANS.-	-C.G.-	-WEIGHT-	-POLAR-
(21) OGIVE	117.904	665.878	1532.663	12.974	203.445	1819.237

When you have positioned the cursor exactly as shown above, depress the P key. P is a draw-mode command which tells PHASOR to display the properties of a particular part of the shell. In this case, the part of the shell whose surface is under the crosshair intersection is an item identified as "OGIVE" in the data base, which is described on the 21st data card of the data base, as indicated by the number in parentheses at the lower left of the display. Furthermore, this particular piece of the shell weighs 117.9 pounds, and has a center of gravity at 12.974 inches. By placing the cursor over other lines on the shell, and depressing P, you may get a display of the properties of any parts of interest.

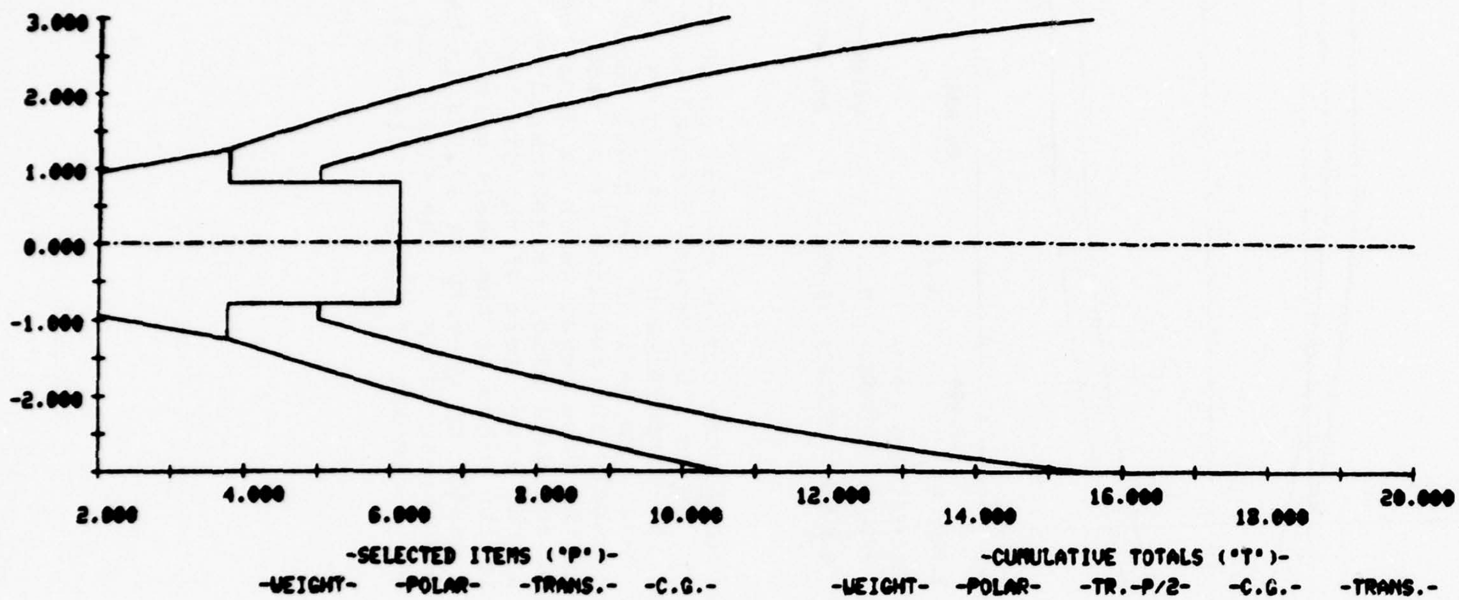
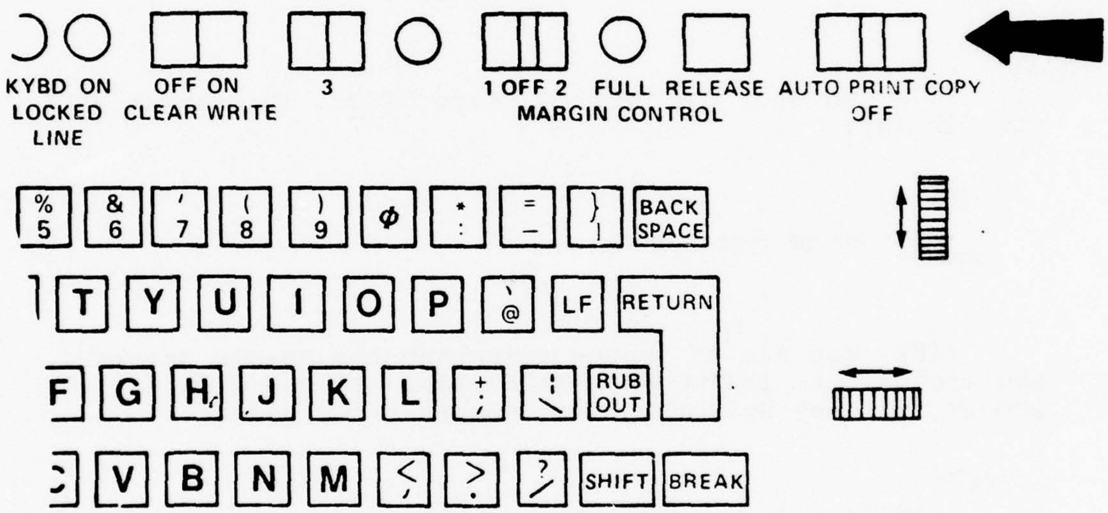


Figure 2-3. Sample shell display illustrating "clipping" of image as a result of "zooming".

(14) If your terminal is equipped with a model 4631 hardcopy unit, you may make a permanent copy of the contents of the screen at any time when PHASOR is waiting for a directive or keystroke, by depressing the AUTO/PRINT/COPY rocker switch on the keyboard.



(15) Depress the Z key. This commands PHASOR to zoom in on a portion of the display. The prompting message,

AXIS XMIN, XMAX=

will appear at the lower left of the screen. Type in

<u>2,20</u>

with a carriage RETURN, to tell PHASOR to display the part of the shell between X=2 and X=20. The screen will erase, and redraw the shell with an enlarged scale, as shown in figure 2-3. Note that all portions of the shell outside the viewing area are <u>clipped</u> off and not displayed. However, using the T graphic input keystroke will still give the properties of the entire shell.

(16) *There are 21 Graphic Input Keystrokes (GINKS)* available in DRAW mode, of which we have tried only three - T, P, and Z. We will examine the other commands available at a later time. Now depress /. The slash GINK always tells PHASOR to return to directive mode from any other mode. The screen will clear, and the directive mode prompting characters will be displayed:

//

(17) To stop the program, type STOP. The screen will now display:

```
//STOP
      STOP  PHASOR- NORMAL TERMINATION.
COMMAND-
```

(18) You are no longer executing the PHASOR program and are back in INTERCOM COMMAND mode. If you wish to LOGOUT, you may do so by the sequence shown below:

```
//STOP
      STOP  PHASOR- NORMAL TERMINATION.
COMMAND- LOGOUT

CPA      5.556 SEC.        5.556 ADJ.
SYS TIME                  11.880
EST. COST AT $180/HR. - $    .59
CONNECT TIME    0 HRS.   18 MIN.
 03/13/78  LOGGED OUT AT 14.50.54.
      <
```

VERY IMPORTANT: AFTER LOGGING OUT AND BEFORE POWERING DOWN THE TERMINAL, DEPRESS SHIFT AND RESET PAGE SIMULTANEOUSLY. Failure to do so may result in the telephone line to the computer becoming permanently "busy".

BODY ITEM DATA CARDS

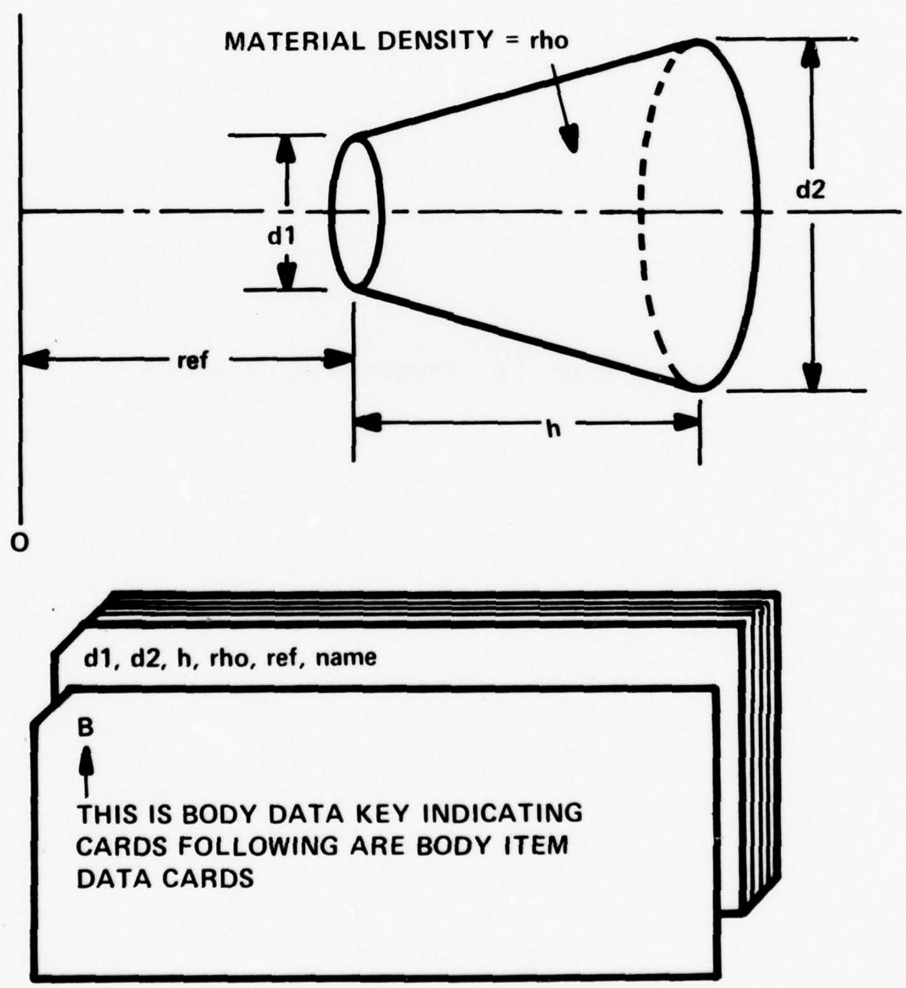


Figure 3-1. Data card format to describe "body" items.

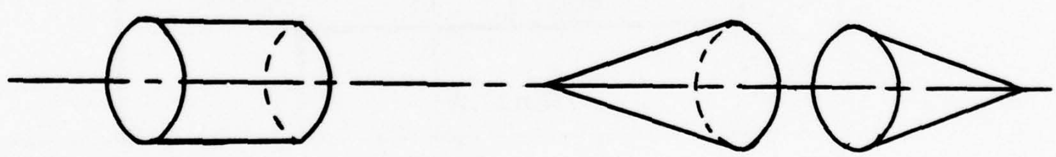
3. MODELLING FUNDAMENTALS & DATA CARD PREPARATION

This section describes the fundamental concepts needed to describe a shell for analysis by PHASOR. Readers who are already familiar with the WEIGHT, DAGMAR or PROMS programs will find this material fundamentally familiar, except for section 3.8, which introduces a new item type, the "PHASOR format" ogive.

Any axially symmetric shell may be analyzed by PHASOR if its physical dimensions and material densities are known. The user must model his shell by breaking it up into a number of elementary "building blocks", or items. The most fundamental and most commonly used building block of PHASOR is the BODY ITEM.

3.1 BODY ITEMS

The general form of a body item is a truncated right-circular cone, as shown in figure 3-1, where the axis of symmetry of the shell is also the axis of symmetry for the body item. Two often-used subsets of the general form are the cylinder (D1=D2) and the cone (D1=0, or D2=0).



(a) CYLINDER (b) CONES

Special subsets of general body item.

Any single body item may be completely described by the four dimensions D1, D2, H, and REF and the material density, RHO. To describe a body item, these values may be punched on a single data card in the sequence shown in figure 3-1. The field on the card called NAME is an optional field consisting of from 0 to 18 characters which may be used to designate a name for the item.

The numerical values for the fields may be freely placed on the data card, but must appear in the same sequence as shown, and must be separated by commas or blanks. The NAME field, if specified, may contain any alphanumeric characters, including blanks, and need not be unique (i.e., more than one body item may have the same NAME field).

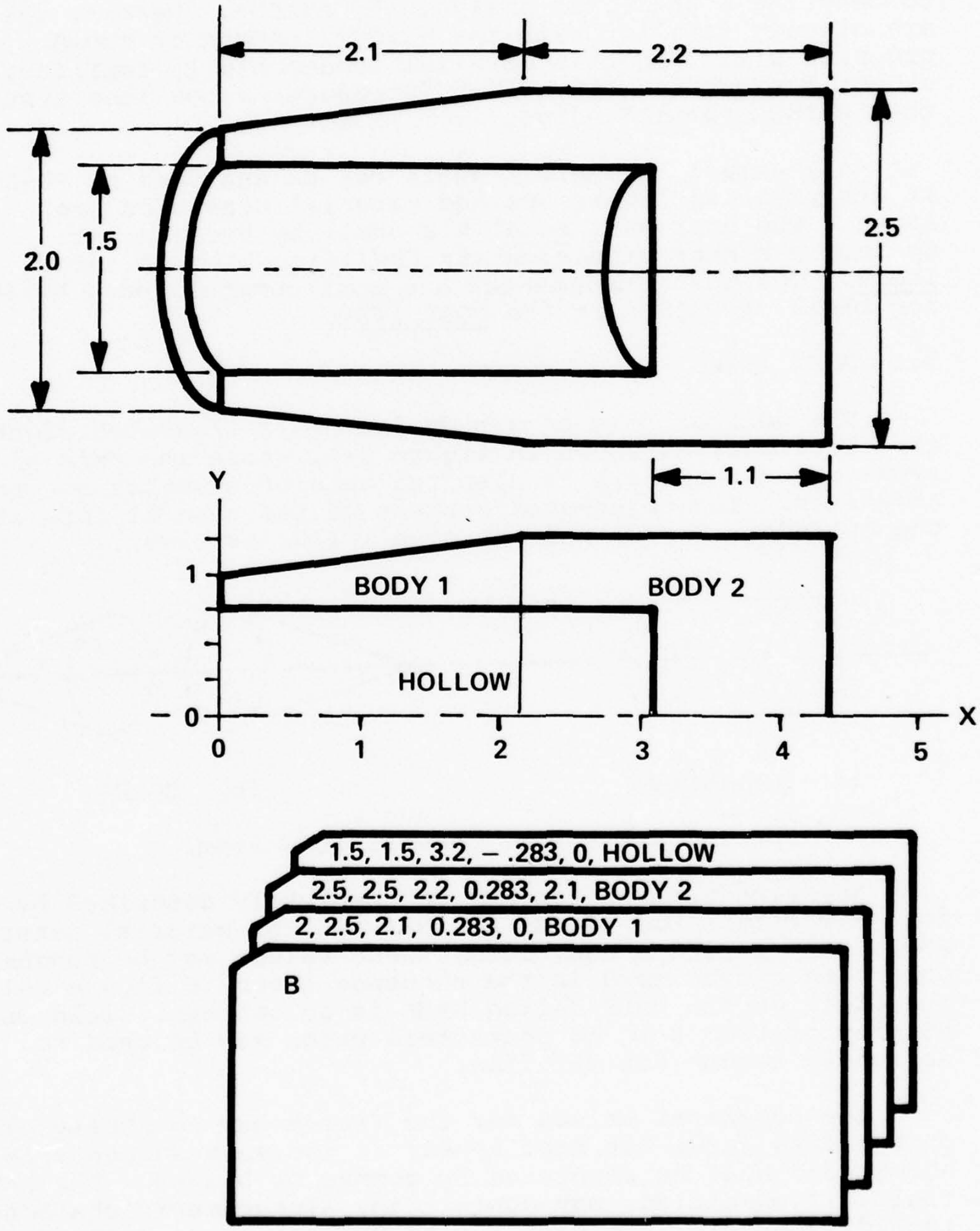


Figure 3-2. Composite shell modelling using "body" items.

3.2 COMBINING ITEMS

Models of shells of any desired complexity may be made up by combining individual body items. For example, the shell whose cutaway view is shown at the top of figure 3-2 may be modelled by combining three body items. To model the shell, the analyst first sketches the cross-sectional view of the shell, as shown in the center of the figure. The analyst decides that in this case, he may model the shell by using two body items to describe the outside contour of the shell, and "subtracting away" the hollow portion of the shell on a third body item. "Subtracting away" is accomplished by specifying a negative density, as shown on the last card at the bottom of the figure. This shell was made of steel, with a density of 0.283 lbs/cubic inch, so by specifying the third item as having a density of -.283, the net result is a density of 0 for the hollow portion.

3.3 BODY ITEM DATA KEY

Only one more card is needed besides the three body item cards to completely describe the shell of figure 3-2. This is the body data key card. The data key card is the first card shown at the bottom of figure 3-2. It contains only the character B in column one. This card tells PHASOR that all the cards which follow are body items, until a different data key card is encountered. Any number of body item cards may follow a body data key. Other data keys will be described later for other items types yet to be defined.

FIN ITEM DATA CARDS

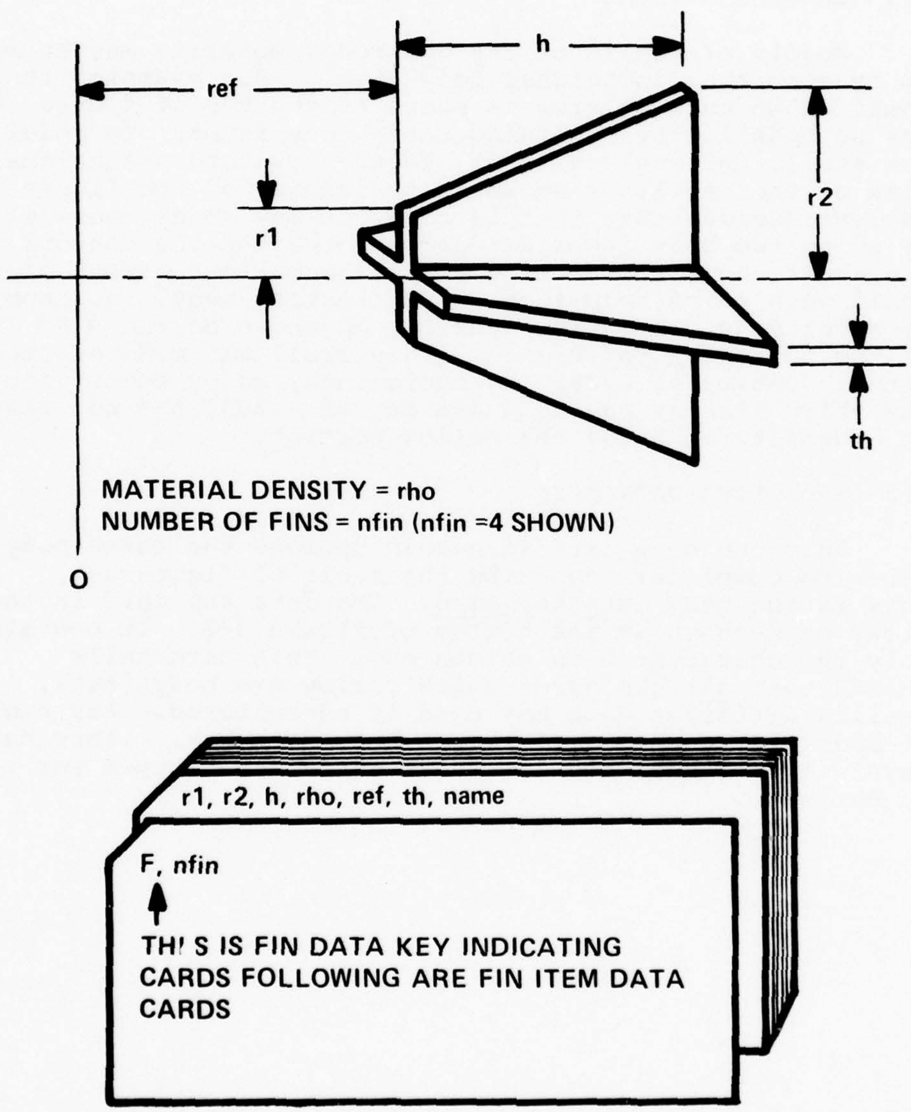


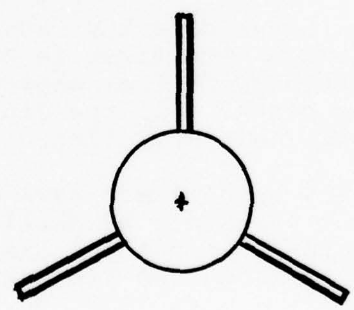
Figure 3-3. Data card format to describe "fin" items.

3.4 FIN ITEMS

A second "building block" is the fin item. Fin items are peculiar in that they break almost all the general rules for items in general, and therefore should be used with caution.

First of all, fin items are not axially symmetric; yet the introduction of this report stated PHASOR was only to be used for axially symmetric bodies. This paradox can be tolerated if we stipulate that the fins must be placed symmetrically around the shell, and that the computed transverse moment of inertia will be the average inertia for a spinning shell (see Appendix F for mathematical derivation). *Fins are* encountered so frequently that it is useful to include them in axisymmetric analysis with these stipulations.

The general form for fin items is shown at the top of figure 3-3. Note that unlike all other item types, the dimension of fins are specified in terms of the radius, not the diameter, of the fin. The reason for this departure from the norm is that fins are not necessarily directly opposite each other, such as in the case of three fins. Using the radius as the standard of measure helps emphasize this distinction, as well as maintaining compatibility with previous programs.



NFIN=3 (END VIEW)

The minimum number of fins on a fin item is 2. Fins are assumed to be placed symmetrically, e.g., if NFIN=3, fins are placed every 120 degrees, as shown above.

Since fins are almost always placed on the "outside" of a shell, fin items will normally have some inside portion "subtracted away". In normal usage, each fin item specified with a positive density will have associated with it another fin item with a complementary density, as illustrated in the example below.

Figure 3-4 shows a simple example problem consisting of a solid steel shell with two aluminum fins. To analyze the shell, the sketch shown in the middle figure is produced, and the data cards shown at the bottom are prepared. The first card is the body data key. The second and third cards are body item cards describing the cylindrical portion and the conical portion of the shell, as discussed in section 3.3.

The fourth card is the Fin data key, which indicates that the cards following it are fin items. The second field on the fin data key is NFIN, the number of fins, in this case 2. Since NFIN=2, it is implicitly understood that the fins are 180 degrees apart.

The fifth card describes the outside edge of the fin. The last card " subtracts away" that portion of the fin which is subtended by the body of the shell.

3.5 FIN ITEM DATA KEY

Unlike the other data keys used by PHASOR, the fin data key has two fields. The first is the character F, and the second is the number of fins, separated from the letter F by a comma or a blank. All the fin items which follow the fin data key will have NFIN fins.

Occasionally a shell may have different numbers of fins around different parts of the shell. For example, a rocket may have four cannards in front and six fins in back. This case can be handled by using two fin data keys, like this...

```
F,4
...
cannard fin item description cards
...
F,6
rear fin description items
...
```

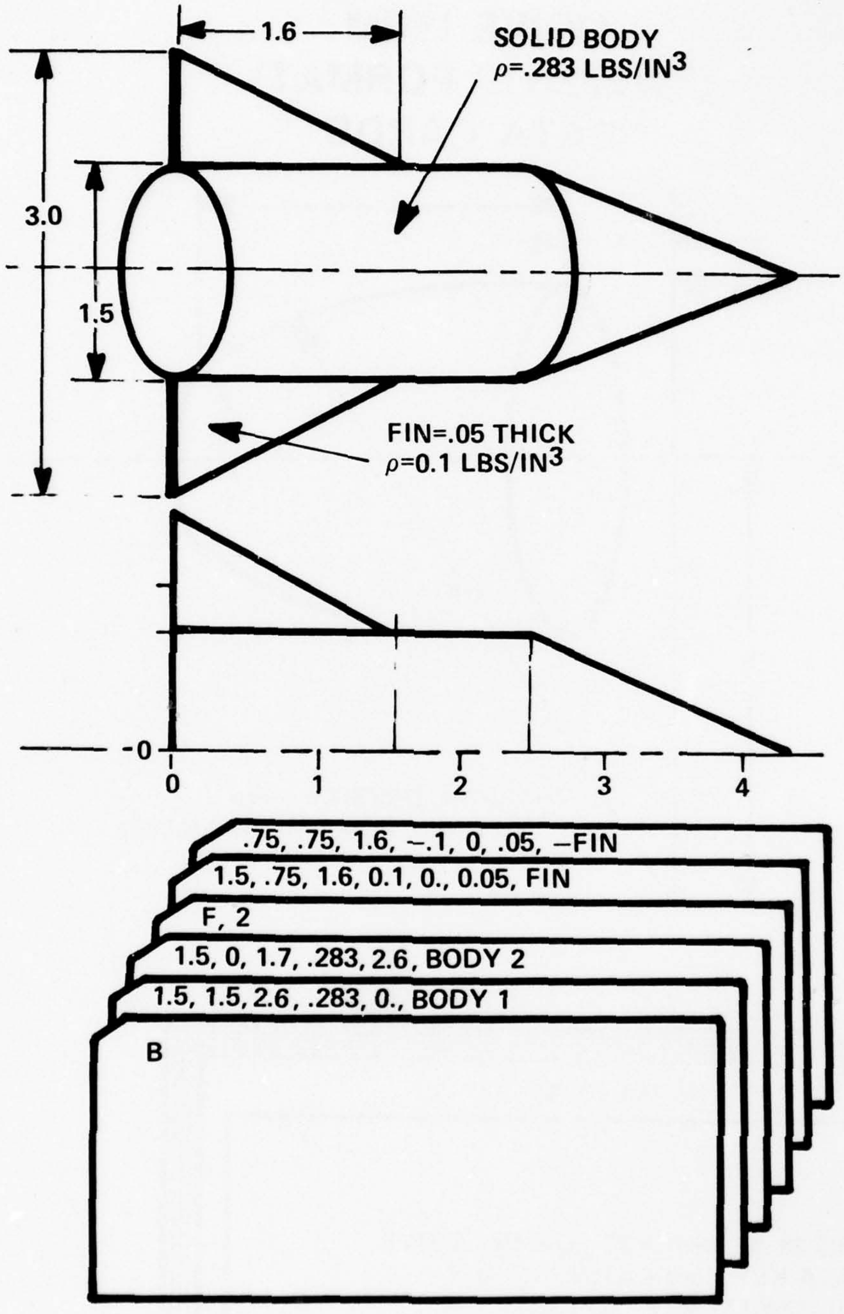


Figure 3-4. Composite shell modelling using "body" and "fin" items.

OGIVE ITEM
("WEIGHT" FORMAT)
DATA CARDS

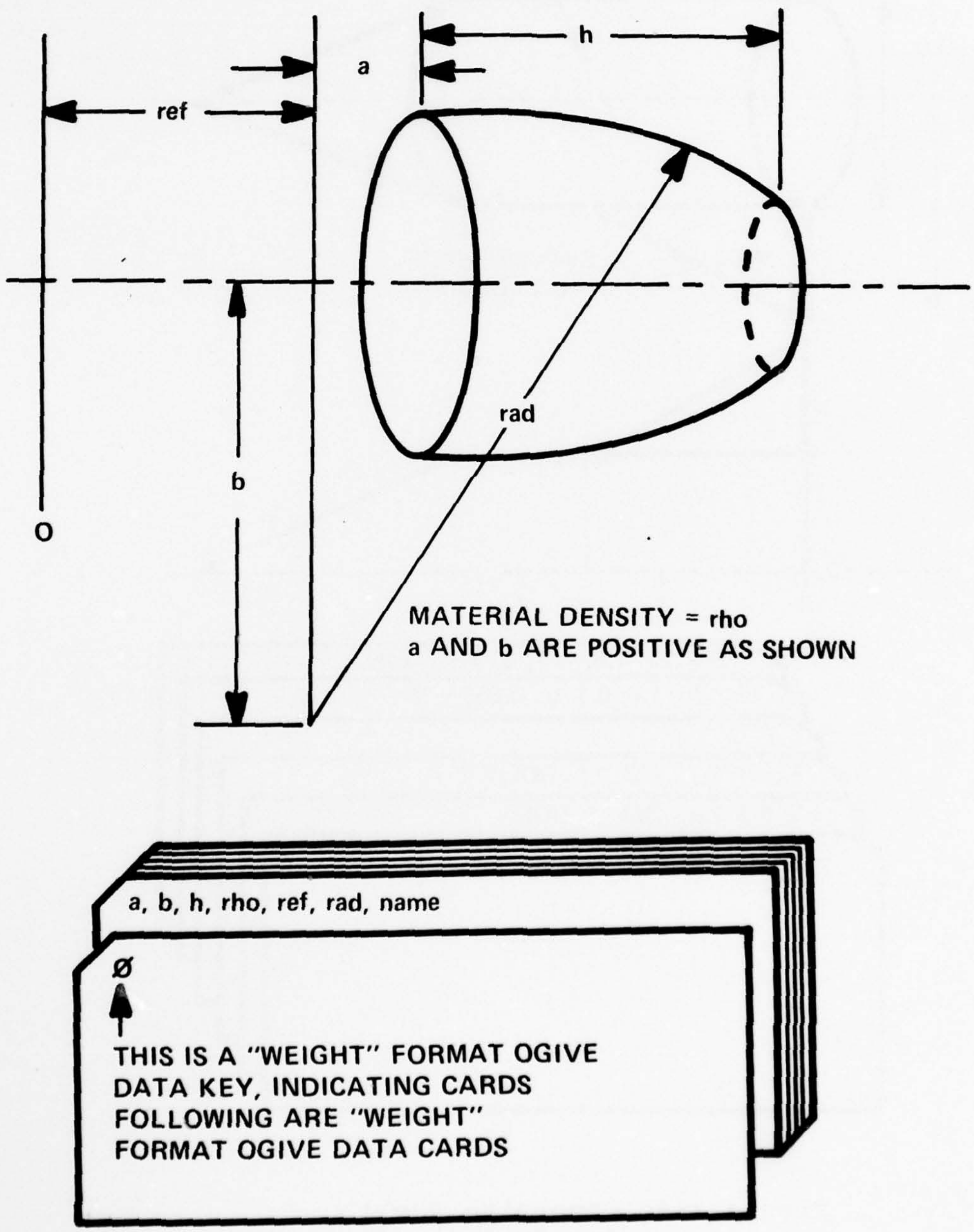


Figure 3-5. Data card format to describe "WEIGHT" format "ogive" items.

3.6 "WEIGHT" FORMAT OGIVE ITEMS

An ogive is a solid generated by rotating a circular arc about the axis of symmetry of the shell.

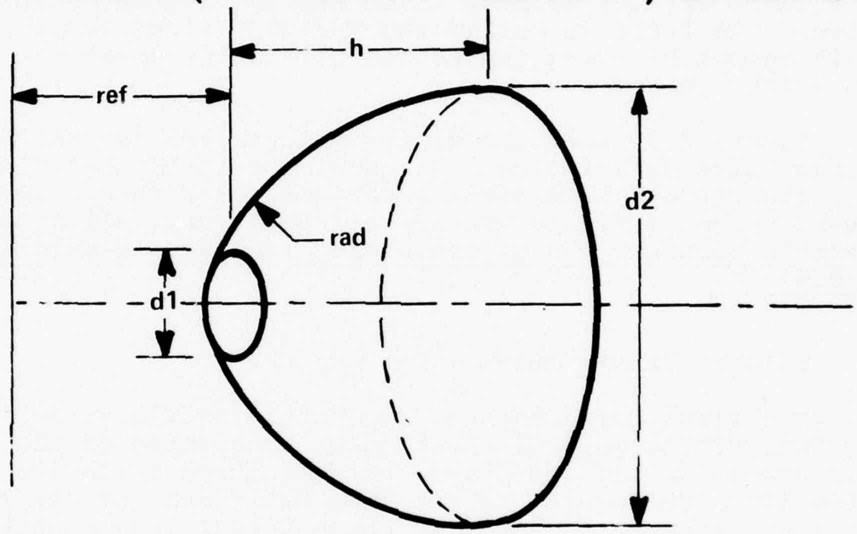
There are two formats which may be used to describe an ogive. The first is called the "WEIGHT" format because it is compatible with the method originally developed for the WEIGHT program.

Figure 3-5 shows the dimensional fields for WEIGHT format ogive description. It should be noted that fields A,B, and RAD all have signs associated with them. For the figure shown, A,B, and RAD are all positive. All other possible combinations of signs are discussed in detail in Appendix E.

3.7 "WEIGHT" FORMAT OGIVE ITEM DATA KEY

The first card shown at the bottom of figure 3-5 is the "WEIGHT" format ogive data key, consisting of the letter O in column 1. It indicates that all cards following are ogive items conforming to the "WEIGHT" format of description, until a different data key is encountered. Any number of ogive item cards may follow the key.

OGIVE ITEM ("PHASOR" FORMAT) DATA CARDS



MATERIAL DENSITY = rho

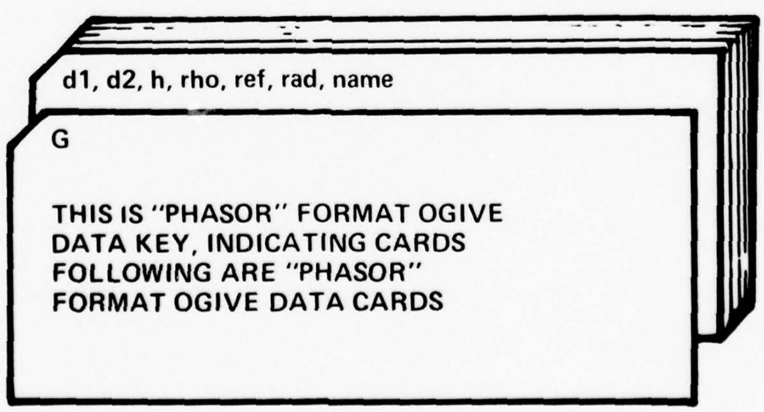


Figure 3-6. Data card format to describe "PHASOR" format "ogive" items.

3.8 "PHASOR" FORMAT OGIVE ITEMS

Section 3.6 introduced the "WEIGHT" format for describing an ogive. One of the problems with this format is that the analyst must know the location of the center of the arc in order to specify dimensions A and B. These dimensions are easily extracted from the final engineering drawings for a shell, but during preliminary design work, the center of the arc is seldom known and troublesome to compute. More often, the designer simply knows he wants to connect two points with an ogive of a given radius. It is for this situation that the "PHASOR" format ogive item is presented.

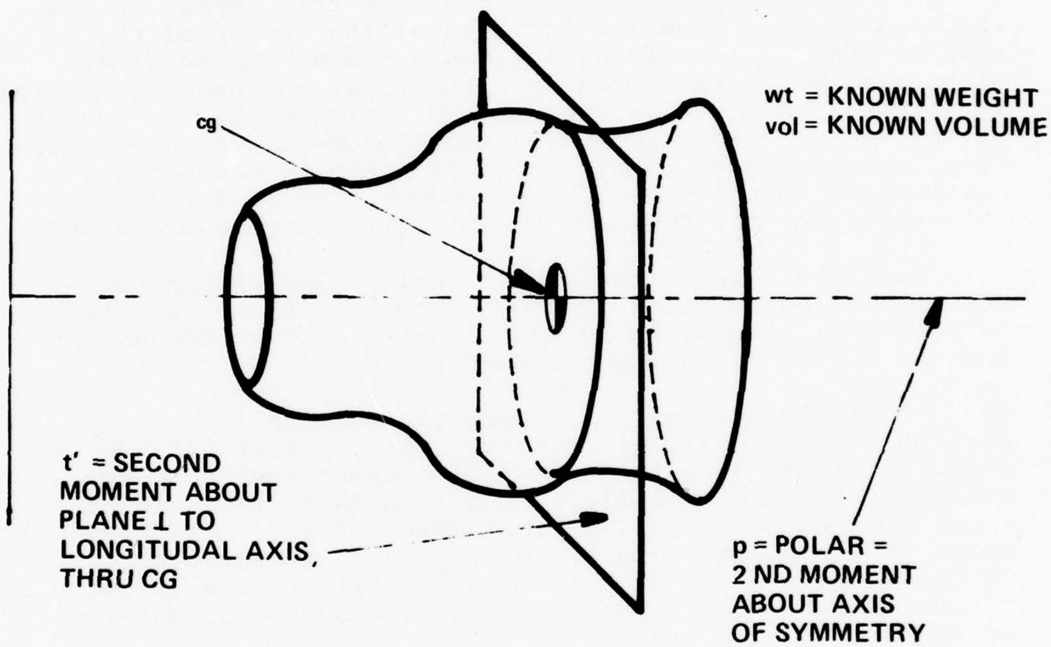
Figure 3-6 shows the dimensional fields needed to describe an ogive using "PHASOR" format. It may be helpful to note that the format is exactly like a body item except the additional field RAD has been added.

The field RAD has a sign associated with it, which governs the concavity of the arc. For positive RAD, as shown in figure 3-6, the arc will be drawn such that the center of the arc will lie to the right side of a vector from coordinates (REF,D1/2) to (REF+H, D2/2). Normally, this means that a positive radius will produce an ogive that "sheds water", and a negative radius will produce an ogive that "holds water". See Appendix E for a complete discussion of the sign of the radius.

3.9 "PHASOR" FORMAT OGIVE ITEM DATA KEY

As shown on the first card of figure 3-6, the letter G in column one is the data key for "PHASOR" format ogives. This card indicates that all cards which follow are ogive item description cards using the "PHASOR" format, until another data key is encountered. Any number of ogive items may follow an ogive data key.

KNOWN ITEM DATA CARDS



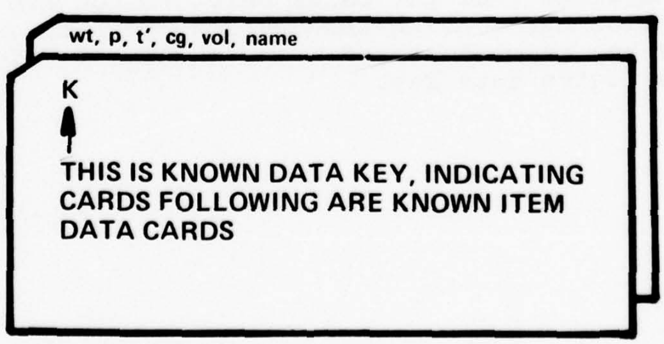


Figure 3-7. Data card format to describe "known" items.

3.10 KNOWN ITEMS

Often the properties of a portion of the shell to be analyzed is known. For example, the shell might use a standard fuze whose properties are well documented. For this situation, it would be foolish to have to describe the known part as a collection of body, fin, or ogive items, since the results are already known. The known item is provided for this contingency.

Figure 3-7 shows the data fields needed for a known item description. All that is needed is the weight, polar moment, planar transverse moment, center of gravity, and volume. Several points may be made about known items:

1. The c.g. must be the c.g. of the item with respect to the origin for the shell. For example, if a known fuze having a c.g. 2.47 inches from its tip is to be used, and it is to be placed on the front of a shell such that the tip of the fuze is 27.94 inches from the tail of the shell at reference 0.0, then the c.g. should be specified as (27.94-2.47)= 25.47 inches.

2. PHASOR will not draw the known item since it has no idea what it looks like.

3. If the known item was previously modelled using PHASOR the quantity T' may be easily extracted from the total properties printout or display. If it was modelled using WEIGHT, DAGMAR, or PROMS, however, T' must be computed from the transverse, T, as follows.......

$$T' = T - (P/2)$$

where P is the total polar moment of inertia.

3.11 KNOWN ITEM DATA KEY

As shown on the first card of figure 3-7, the known item data key card consists of the letter K in column 1, and indicates that all cards which follow are known items, until another data key is encountered. Any number of known items may follow a known item data key.

3.12 DATA CARD SEQUENCE

PHASOR allows data cards to be input in any sequence, subject to the stipulation that a data key must preceed data cards of the corresponding type. Furthermore, all data cards of given type need not be grouped together. For instance, a deck may contain a body data key, some body items, an ogive data key, some ogive items, then another body item key and more body data cards. The following example illustrates a legal sequence.

```
G
("PHASOR" format data cards)
F3
(fin items)
K
(known items)
O
("WEIGHT" format ogive items)
F3
(fin items)
G
("PHASOR" format ogive items)
END
```

Note that no body items were included. Only those item types desired need be included.

3.13 SUMMARY OF MODELLING FUNDAMENTALS

Any axially symmetric shell, or axially symetric shell with symmetrically placed fins may be analyzed as a composition of body, fin, ogive, and known items. One item is normally described on one data card, and as many data cards as needed may be used for each type of item. Item types are differentiated by placing a data key card in front of the cards of similar type. There are two forms for the ogive item, the WEIGHT format and the PHASOR format. Either or both may be used.

Data keys have a particular character is column 1 which indicates the type of items that are followed. For fin items, the data key also contains the number of fins per item.

Data cards contain numeric fields of from 1 to 9 characters separated by commas, blanks, or both. For all items, the optional field NAME may be included if desired, and may consist of 1 to 18 alphanumeric characters including blanks.

The format for the various item types is summarized below:

BODY:

B
dl, d2, h, rho, ref, name

FIN

F, NFIN
rl, r2, h, rho, ref, th, name

"WEIGHT" format OGIVE:

O
a, b, h, rho, ref, rad, name

"PHASOR" format OGIVE:

G
dl, d2, h, rho, ref, name

KNOWN:

K
wt, p, t', cq, vol, name

SELF – KEYED DATA CARDS

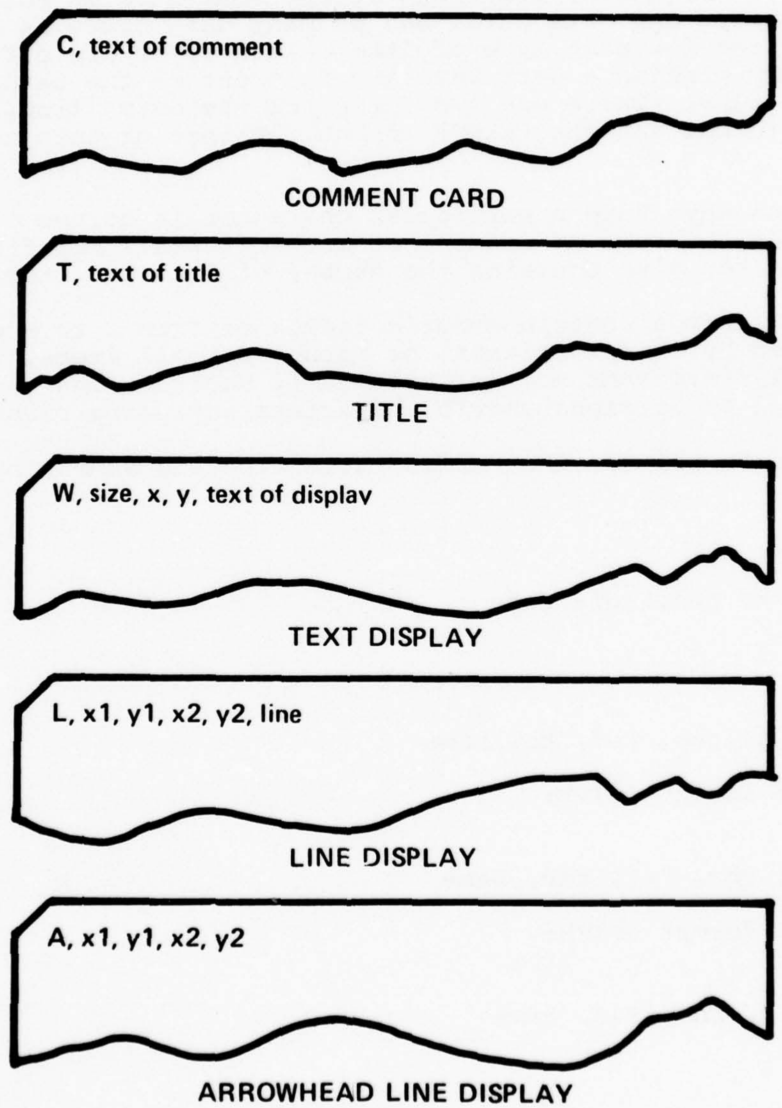


Figure 3-8. Data card format to describe "self-keyed" items.

3.14 SELF-KEYED DATA CARDS

Besides the basic cards needed to describe the shell itself, PHASOR provides five other types of cards which may be placed anywhere in the data deck. These five types of cards are illustrated in figure 3-8. These cards are referred to as "self-keyed" data cards because both the data and the "data key" letter are contained on the same card, unlike the data cards already described, which must have an identifying "data key" card preceeding the data cards.

Any of these cards may be freely interspersed in the deck without adversely affecting the regular cards. The purpose of each of the five "self-keyed" data cards is described below:

1) COMMENT CARD. The comment card is identified by a "C" in column 1. It has no effect on the computation or display of the shell, but will appear in the EDIT file and on the OUTPUT file, and may therefore be used in any manner desired by the user to document his deck. All material on the card after the "C" in column 1 is considered as a comment. As many comment cards as desired may be used.

2) TITLE CARD. The title card is identified by a "T" in column 1. It has no effect on computation of display, but will cause PHASOR to print the text of the card at the top of each page of the listing on file OUTPUT after the deck is read and analyzed. The text of the title may be anywhere on the card, and will be automatically centered on the page on OUTPUT. Only one title card should be used in a deck. If more than one is present, only the last title card will be used.

3) WRITE-TEXT-ON-DISPLAY CARD. This card is identified by a "W" in column 1. It has no effect on computation, but will cause a line of text information to be displayed during DRAW mode at the coordinates specified. The fields shown in figure 3-8 are defined as follows:

SIZE is the desired character size, expressed in the dimensions of the shell.

X is the starting X coordinate of the lower left-hand corner of the text to be displayed.

Y is the starting Y coordinate (radius) of the lower left hand corner of the text to be displayed.

TEXT OF DISPLAY is the desired character string of from 1 to 39 characters.

As many "W" cards as desired may be used in a deck.

4) LINE DISPLAY CARD. This card is identified by a "L" in column 1. It has no effect on computation, but will cause PHASOR to draw a solid line on the DRAW MODE display at the position specified. It is useful for underlining or placing a box around text display, or for other enhancements to the display. The fields shown in figure 3-8 are defined as follows:

X1 is the starting X coordinate of the line.

Y1 is the starting Y coordinate (radius) of the line.

X2 is the ending X coordinate of the line.

Y2 is the ending Y coordinate (radius) of the line.

LINE is line type. A solid line will be drawn if LINE is omitted or 0. A dashed line will be used for LINE=1.

5) ARROWHEAD LINE DISPLAY CARD. This card is identified by an "A" in column 1. It has no effect on computation, but will cause PHASOR to draw a line terminated with an arrowhead at the specified location. It is useful for indicating specific parts of a shell drawing. The fields shown in figure 3-8 are defined as follows:

X1 is the starting X Coordinate of the line.

Y1 is the starting Y coordinate (radius) of the line.

X2 is the coordinate of the arrowhead and of the line.

Y2 is the Y coordinate (radius) of the arrowhead end of the line.

An example of the "W", "L" and "A" cards are illustrated in figure 3-9, which shows the EDIT file used to create the display of figure 3-10.

```
( 1)
W          .5         4.         1.         THIS IS A  W  DISPLAY
L          4          .5         9.         .5
L          4          2          12         3          1
A          2          3          7          3
%EOF

( 4 OF   4)
```

Figure 3-9. A sample EDIT file
showing 4 "self-keyed" data
cards, which will produce the
DRAW-mode display of figure 3-10.

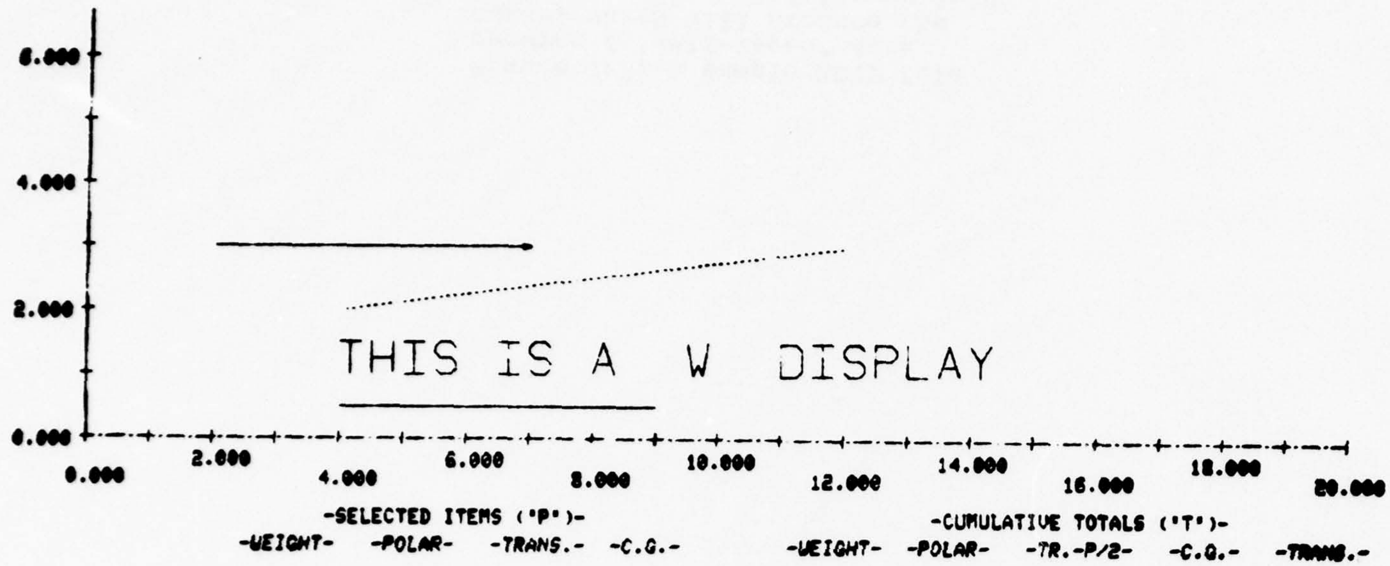


Figure 3-10. Sample DRAW-mode display produced from card images of self-keyed data cards shown in figure 3-9.

4. FILES AND FILE-ACTION DIRECTIVES

In section 3 we learned how to describe a shell on punched cards in a format PHASOR can understand. In order for PHASOR to be able to read the deck of data cards, the cards must be placed in a FILE on the computer's mass storage devices. Section 4.1 describes how to create a PERMANENT FILE from punched cards. The remainder of section 4 describes the DIRECTIVES which may be used to manipulate files with PHASOR.

You may recall from section 2 that PHASOR is initially in the DIRECTIVE mode after beginning execution, and this state is indicated by the display of two slashes:

//

PHASOR provides a variety of DIRECTIVES which are similar to INTERCOM commands for manipulating, creating, and destroying files. This section introduces these DIRECTIVES, which are described as a class as FILE ACTION DIRECTIVES. The following DIRECTIVES are available:

ATTACH	locates a PERMANENT FILE on mass storage.
READ	reads a LOCAL FILE for analysis.
SAVE	creates a LOCAL FILE.
NEW	indicates the beginning of a new shell file.
CATALOG	makes a LOCAL FILE PERMANENT.
PURGE	discards a PERMANENT FILE.
RETURN	releases a local file.
PUNCH	punches a file of cards at the central site.

The general syntactical format of all DIRECTIVES is:

//<u>DIRECTIVE,parameters,options</u>

where DIRECTIVE is a keyword directive name, <u>parameters</u> are required informtion supplied by user, and <u>options</u> are optional specifications provided at will by user. Options are not required and will not be discussed until section 10. The <u>parameters</u> required depends on the directive.

4.1 CATALOGGING PUNCHED CARD DECKS FOR PHASOR

For many PHASOR users, punched cards provide a convenient input medium, because "USER 200" terminals or other BATCH remote terminals are available in close proximity to the TEKTRONIX terminal. Cards give user a permanent copy of his data that he can retain as long as needed, too. For these reasons, we will begin by assuming that the user will punch his data on cards.

In order for PHASOR to be able to read a deck of punched cards, the data deck must first be CATALOGED into the computer's mass memory on a permanent file. The following deck will perform this function:

```
PERM.
COMMENT.(billing code), myname
REQUEST,DATA,*PF.
COPYBF,INPUT,DATA.
CATALOG,DATA,mypermfilename,ID=myname.
7/8/9 card
        } your PHASOR data deck
6/7/8/9/ card
```

In the deck above, myname is the user's name, and mypermfilename is the name user wishes to assign to his data file, e.g., "M106WARHEAD". Syntactical requirements and a complete explanation of the above control cards is available in the SCOPE reference manual (reference 1).

This section assumes some foreknowledge of files on the part of the reader. If the reader does not feel comfortable about his understanding of PERMANENT FILES, he should read appendix B of this manual as well as reference 1 section 5 before proceeding.

4.2 ANALYZING DATA ON A PERMANENT FILE CARD DECK

Once a deck of cards has been put in a permanent file, it may be freely accessed by PHASOR. After logging in, as explained in section 2, PHASOR is in the DIRECTIVE mode, as indicated by the two slash marks on the screen:

//

We may now direct PHASOR to fetch your particular deck from mass storage so it can read it. This is performed by an ATTACH directive. The format for an attach directive is:

<u>//ATTACH,lfn,mypermfilename,ID=myname,CY=n</u>

Users familiar with INTERCOM or EDITOR will recognize that this format is the same as the ATTACH command. However, there are some differences between a PHASOR ATTACH directive and an INTERCOM ATTACH command. These differences include:

(1). All fields must be included in the directive, including CY=n. There are no defaults.

(2). The fields must be separated by commas, not parentheses.

(3). The ATTACH command may be abbreviated as any word starting with ATT.

As is the convention of this manual, the fields shown in lower case letters above must be supplied by the user. These fields are:

<u>lfn</u> is a temporary file name, 1 to 7 letters or numbers, with the first character alphabetic. After the ATTACH, the permanent file will always be referred to by the temporary file name, lfn, not the permanent file name.

<u>mypermfilename</u> is the permanent file name under which the data was stored, e.g., as in the example of section 1, "M106WARHEAD". It may be 1-38 letters or numbers long, with the first character alphabetic.

myname user's name under which the data was CATALOGed.

n The number of the cycle on the file. If file was cataloged without a CY designation, and this is the first file CATALOGed under that file name, then CY=1.

Example 1:

Suppose user had previously cataloged his data for the M106 using the deck described in section 4.1, with the following CATALOG card:

CATALOG,DATA,M106WARHEAD,ID=KOJAK.

To retrieve the data file, user could enter the following directive at the TEKTRONIX terminal after beginning PHASOR:

//ATTACH,A,M106WARHEAD,ID=KOJAK,CY=1.

Notice that the lfn field is not necessarily the same as when the data was CATALOGED. In this case user chose to refer to the permanent file by the local file name A. The permanent file name, ID, and CY must correspond exactly, however. In this case the default cycle number of 1 was used on the catalog, but since no defaults are permitted on the ATTACH directive, user specified CY=1.

Once user has entered the above directive, any directive which references file A will act on user's permanent file.

User's permanent file is now ready to be used. In order to analyze the data on the file, PHASOR must READ the deck. This is simply accomplished by giving PHASOR a READ directive.

Example 1:

//READ,lfn

lfn is a local file name, such as A above.

Example 2:

After the above ATTACH directive, user wishes to have PHASOR analyze his shell. To activate the data, user types:

//READ,A

Upon receipt of a READ directive, PHASOR will display an acknowledgement of the form:

```
PHASOR READS DATA SET    n OF FILE  lfn
   m CARD IMAGES READ.
```

where n is the number of the data set, normally 1, and m is the number of card images in user's permanent file data deck.

Example 3:

To continue with the case of example 2 above, PHASOR acknowledges the READ, A directive:

```
PHASOR READ DATA SET    1 OF FILE A
   44 CARD IMAGES READ.
//
```

In this case there were 44 cards between the 7/8/9 card and the 6/7/8/9 card of user's *original punched card deck* of example 1 of section 4.1.

The file A has not been read by PHASOR, and user may direct the program to display the shell, alter the shell, analyze the shell, etc. When PHASOR reads a file, the card images are placed on a special file called the EDIT file. The original file A remains intact however, and even if the user causes changes in the shell being analyzed, only the EDIT file, not the permanent file, is altered.

If desired, several files may be combined for analysis. In order to do this, user may merely ATTACH and READ another **pre-CATALOGed data base.**

Example 4.

User has previously catalogued another data set describing the M1 Fuze, 20 cards:

```
CATALOG, DATA,M1FUZESTD,CY=1,ID=MANNIX.
```

User now wishes to combine the fuze model with the M106 warhead model he has already read as in examples 1 to 3 above. He may use the following directives:

```
//ATTACH,B,M1FUZESTD,ID=MANNIX,CY=1.
//READ,B
PHASOR READS DATA SET  1 OF FILE B
   20 CARD IMAGES READ.
//
```

PHASOR has now read 20 additional cards into the EDIT file after the original 44 cards of file A. If PHASOR is now directed to display the shell, it will display both the warhead and the fuze. This shows how various components or modules of a shell may be separately stored and combined at will for analysis.

Anytime PHASOR receives a READ directive, it assumes the new file is to be appended onto the existing EDIT file. In order to start a whole new shell, the existing EDIT file must be discarded. This is done by a new directive:

//NEW

The NEW directive tells PHASOR to discard any existing cards in the EDIT file and prepare for a new shell to be entered.

Example 5:

After analyzing the shell read in from files A and B above, user wishes to analyze a different shell, the 8 inch XM650, stored in permanent file XM650MOD27A.

```
//ATTACH,DATA,XM650MOD27A,CY=1,ID=KOJAK.
//NEW
//READ,DATA
PHASOR READS DATA SET  1 OF FILE DATA
   107 CARD IMAGES READ.
//
```

Since user typed NEW before READ, PHASOR will discard the contents of the edit file before reading file DATA, so that only the 107 cards of DATA are copied on the EDIT file.

Often the contents of the edit file should be saved rather than discarded before starting a new shell. For instance, the warhead and fuze analyzed above could have been saved together as a single file. The contents of the EDIT file may be copied to a local file name (which is not already in use) at any time by using the SAVE directive:

//SAVE, lfn.

Example 6:

After combining file A and B in example 4 above, user decides to save the composite shell on a new local file. He decides to call the new file AANDB, and creates it with the SAVE directive:

```
//SAVE,AANDB
PHASOR SAVED 64 CARDS ON FILE AANDB
//
```

The acknowledgement from PHASOR gives the total number of cards copied onto the new file from the EDIT file.

It should be noted that file AAND B is not a permanent file, but is merely capable of being made into a permanent file. To make the file permanent, it should first be SAVED as above, and then CATALOGED.

//CATALOG,lfn,permfile,ID=name,CY=n.

For the CATALOG directive, lfn must be an existing local file name on a permanent file device. Local files generated by SAVE **directives** are always on permanent file devices. permfile, name and n have the same meaning as for the ATTACH directive. As with ATTACH, all parameters are required. The combination of permfile, name and n must not already exist.

Example 7:

User wishes to save his file AANDB which was created by a SAVE directive as a permanent file for future access. After the save directive of example 6 he types:

```
//CATALOG,AANDB,M106WHWFUZE,ID=KOJAK,CY=1.
CT ID=  KOJAK PFN=M106WHWFUZE
CT CY=  01  00000768 WORDS.
```

The acknowledgement generated by the system includes an echo of the permanent file name, ID and cycle number plus its length in memory words.

Sometimes users may wish to destroy unwanted permanent files. This may be done by a PURGE directive on a local file previously ATTACHED.

//PURGE,lfn.

Example 8:

After cataloging file AANDB, user decides he no longer wishes to retain his permanent file containing the M106 warhead alone, M106WARHEAD. This file is already attached with the local file name B, so to destroy the permanent file, user can merely type,

//PURGE,B

The permanent file corresponding to B will be destroyed. However, the local file B still exists until user logs-out or RETURNs file B.

A local file may be RETURNed when it is no longer needed. If it is permanent file, it will be retained in mass storage. IF it is not a permanent file, it will be discarded. The format for a RETURN directive is:

//RETURN,lfn.

Where lfn is an existing local file name.

Example 9:

After PURGING the permanent file associated with local file B, user also wishes to discard the local file B.

//RETURN,B

The user may wish to punch the contents of the EDIT file on cards at the central site. To do this, a PUNCH is provided:

//PUNCH

Example 10:

User has an EDIT file with 77 cards in it, and wishes to punch a copy of the deck for furture use. User enters,

```
//PUNCH
PHASOR PUNCHED  77 CARDS.
DECK NAME WILL BE DHDHI74.
//
```

The acknowledgement displayed includes not only a count of the cards punched, but the unique identifying banner name which will be on the first card of the punched deck. This will greatly aid in identifying the punched deck when it is picked up at building 351.

The above directives comprise the set of file-action directives for PHASOR. In review, the formats for the allowable file-action directives are:

```
ATTACH,lfn,permfile,ID=name,CY=n
READ,lfn
NEW
SAVE,lfn
CATALOG,lfn,permfile,ID=name,CY=n
PURGE,lfn
RETURN,lfn
PUNCH
```

Users who are not completely satisfied with their understanding of a permanent and local files should review the explanatory material in appendix B of this manual, which provides useful background information for any activities on the CDC 6000 computer, not just for PHASOR.

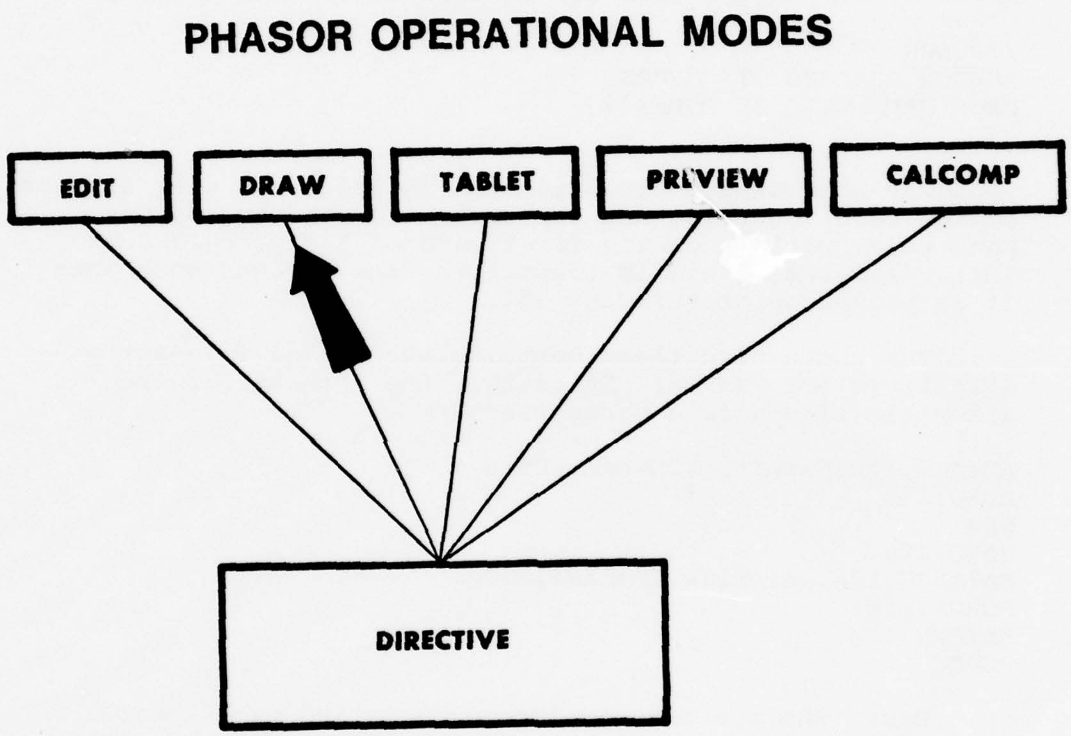


Figure 5-1. PHASOR operating modes.

5. DRAW MODE OPERATION

As shown in figure 5-1, there are six principle modes of operation for PHASOR. The basic mode, introduced in sections 2 and 4, is DIRECTIVE mode, whereby user directs PHASOR to perform certain pre-defined tasks by entering COMMAND-like statements.

EDIT, DRAW, TABLET, AND PREVIEW operational modes may be distinguished from DIRECTIVE mode primarily by the fact that user initiates tasks by depressing a single key on the keyboard, instead of typing an entire command. Each of the keys is uniquely coded for some task. For instance, in section 2, we saw tht the character T in DRAW mode meant "display Total properties of shell" to PHASOR.

In EDIT, DRAW, TABLET, or PREVIW mode, any time the crosshair cursor is displayed on the screen, PHASOR is waiting for user to depress a key to initiate a task. The particular key chosen is called a Graphic Input Keystroke, or GINK.

The first of these modes we shall consider is DRAW mode. DRAW mode is used to display a picture of all or part of a shell, display total or selected individual properties or modify the shell.

To enter DRAW mode from DIRECTIVE mode, the DRAW directive is used:

//DRAW

The DRAW directive will cause PHASOR to enter DRAW mode, erase the screen, draw and scale the axes and the shell (if any shell is in the EDIT file) and display headers for total and individual properties.

If this is the first DRAW directive for the shell configuration, PHASOR will automatically scan the shell dimensions and select a set of axes such that the entire shell will fit on the screen with "neat" tic mark annotations on the axes. In section 10 we shall see how options may be specified on the DRAW directive to alter the axis size and tic marks.

If no shell is in the PHASOR EDIT file, then a set of default axes will be drawn scaled 20 inches long.

The user will be able to recognize when PHASOR is done drawing because the crosshair cursors will appear on the screen, indicating readiness for a GINK (Graphic Input Keystoke).

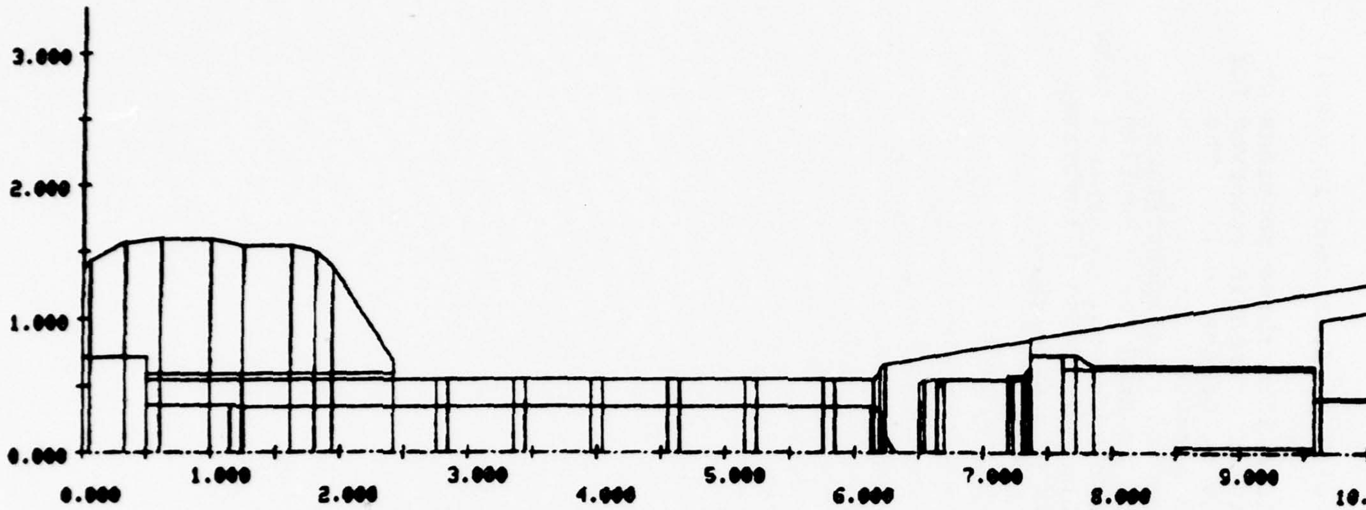
GINKS will be identified in this manual by a single capital letter with a circle around it. Remember that to enter a GINK, only the indicated letter should be depressed. Do not depress carriage return. As soon as the key is depressed, the cursors will disappear and PHASOR will complete the task implied by the key. Some tasks require more than one GINK to be completely defined, in which case the cursors may reappear. Some tasks require the entry of auxilliary data, in which case a prompting message will be displayed.

For DRAW mode the following GINKS are defined:

A Draw a line terminated with a arrowhead at the cursor position.
B Begin a body item at cursor position.
C Continue or complete previous item type at cursor position.
D Change density and begin new item of same type as previous item, at cursor position.
E Erase item under cursor.
F Begin fin item at cursor position.
G Begin PHASOR format ogive at cursor position.
H Display total properties including outer volume and make a hardcopy of totals and subtotals on file OUTPUT.
K Begin known item description.
L Draw a line to cursor position.
M Move invisibly to cursor position.
N Begin a new shell; discard existing shell on the EDIT file.
O Begin a WEIGHT format ogive at cursor position.
P Display properties of item(s) under cursor.
R Redraw shell.
S Suppress entry of L, A, and W GINKS into EDIT file.
T Display total properties of shell (but not outer volume)
U Restore entry of L, A, and W GINKS into edit file ("undo" effects of prior S gink).
W Write text on display beginning at cursor position.
X Remove item under cursor (same as E GINK).
Z Zoom in (or out) on part of display.
/ Return to DIRECTIVE mode of operation.

Each of the GINKS above will be discussed in detail.

The DRAW display is divided into three sections on the screen. The top third of the screen is reserved for the axes and cross-sectional view of the shell. The middle third of the screen is reserved for displaying selected individual properties and total properties. The bottom third of the screen is used for prompting messages, data entry, and error messages. A typical DRAW mode display is shown in figure 5-2, which illustrates material in all three areas of the display.



-SELECTED ITEMS ('P')-

	-WEIGHT-	-POLAR-	-TRANS.-	-C.G.-
(20) BODY1	4.029	2.796	3.891	9.402
(32) -BODY14	-2.736	-1.934	-1.118	10.864
(41) OCTOL1	.630	.446	.258	10.864
(6) FIN4	.291	.058	.021	6.850

-CUMULATIVE TOTALS ('T')-

-WEIGHT-	-POLAR-	-TR.-P/2-	-C.G.-	-TRANS.-
9.160	11.970	137.995	12.502	143.980

(OUTER VOLUME = 75.7377)

BAD KEYSTROKE. TRY AGAIN.
DENSITY =.283

Figure 5-2. Typical DRAW mode display.

5.1 Ⓐ GINK

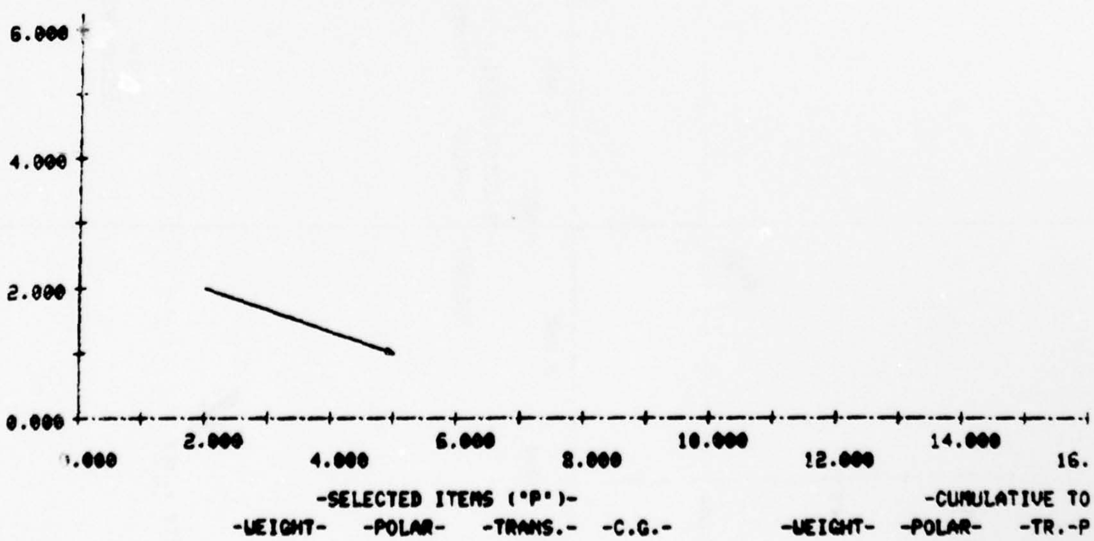
Purpose: To draw a line with an arrowhead from the <u>last</u> position of the cursor to the present position of the cursor.

Discussion: This GINK is usually used in conjunction with the Ⓦ GINK to produce a label on the drawing with an arrowhead to some portion of the display of interest. The Ⓐ gink is usually preceeded by an Ⓜ gink to define the start of the arrowhead line.

Entering an Ⓐ GINK causes PHASOR to add an A type item to the data base in the EDIT file, so the arrowhead line becomes a permanent part of the data base, and will be automatically redrawn during a redraw or zoom operation. If this is not desired, a temporary arrow which is not part of the EDIT file data base may be drawn by preceeding the Ⓐ GINK with an Ⓢ GINK (see section 5.16).

<u>Example:</u>

User desires to draw an arrowhead line from coordinates (2,2) to (5,1), which is to become part of the data base. He positions the crosshair cursor to location (2,2) and depresses Ⓜ to move visibly to that location. He then moves the crosshair cursor to (5,1) and depresses Ⓐ. The resulting display is shown below.



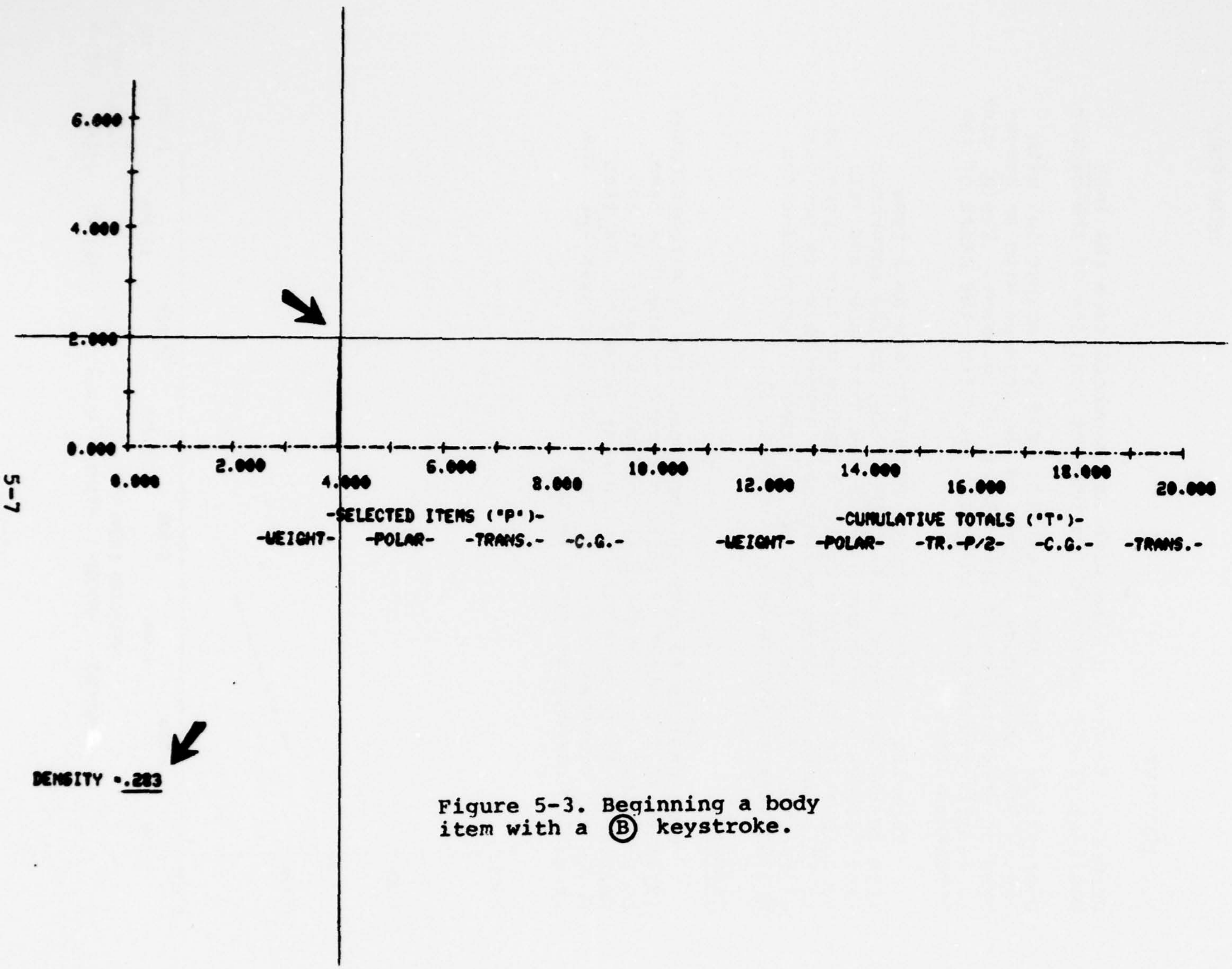


Figure 5-3. Beginning a body item with a B keystroke.

5.2 Ⓑ GINK

Purpose: To begin a body item which is to be added to the display and the EDIT file data base.

Discussion: This GINK is used to define the left endpoint of a body item. A complete body item construction may be completed in three steps:

(1) Move crosshair cursor to left endpoint of desired body item to be constructed, depress Ⓑ.

(2) In response to PHASOR's prompting message, "Density=", type in the desired density of the body item to be constructed, and depress RETURN.

(3) Position the crosshair cursors to the right endpoint of the body item and depress Ⓒ.

More body items of the same density can be constructed by using the "shortcut" method described in section 5.3.

Example:

User wishes to construct a body item with the following properties using DRAW mode:

D1=4.0   D2=6.0   H=5.0   RHO=.283   REF=4.0

To construct the item, he moves the crosshair cursor to the left endpoint, (4,2) and depresses Ⓑ. PHASOR then prompts him to enter the density of the item, as shown in figure 5-3. User types in ".283" and depresses RETURN. The crosshair cursor reappears, and user positions it to (9,3) and depresses Ⓒ. The body item desired is now complete, as shown in figure 5-4. PHASOR will automatically create a corresponding data card at the end of the EDIT file which will look like this:

```
B
4.0000      6.0000    5.0000     0.2830     4.0000
```

Note that no NAME field is produced on data cards generated by DRAW mode entries.

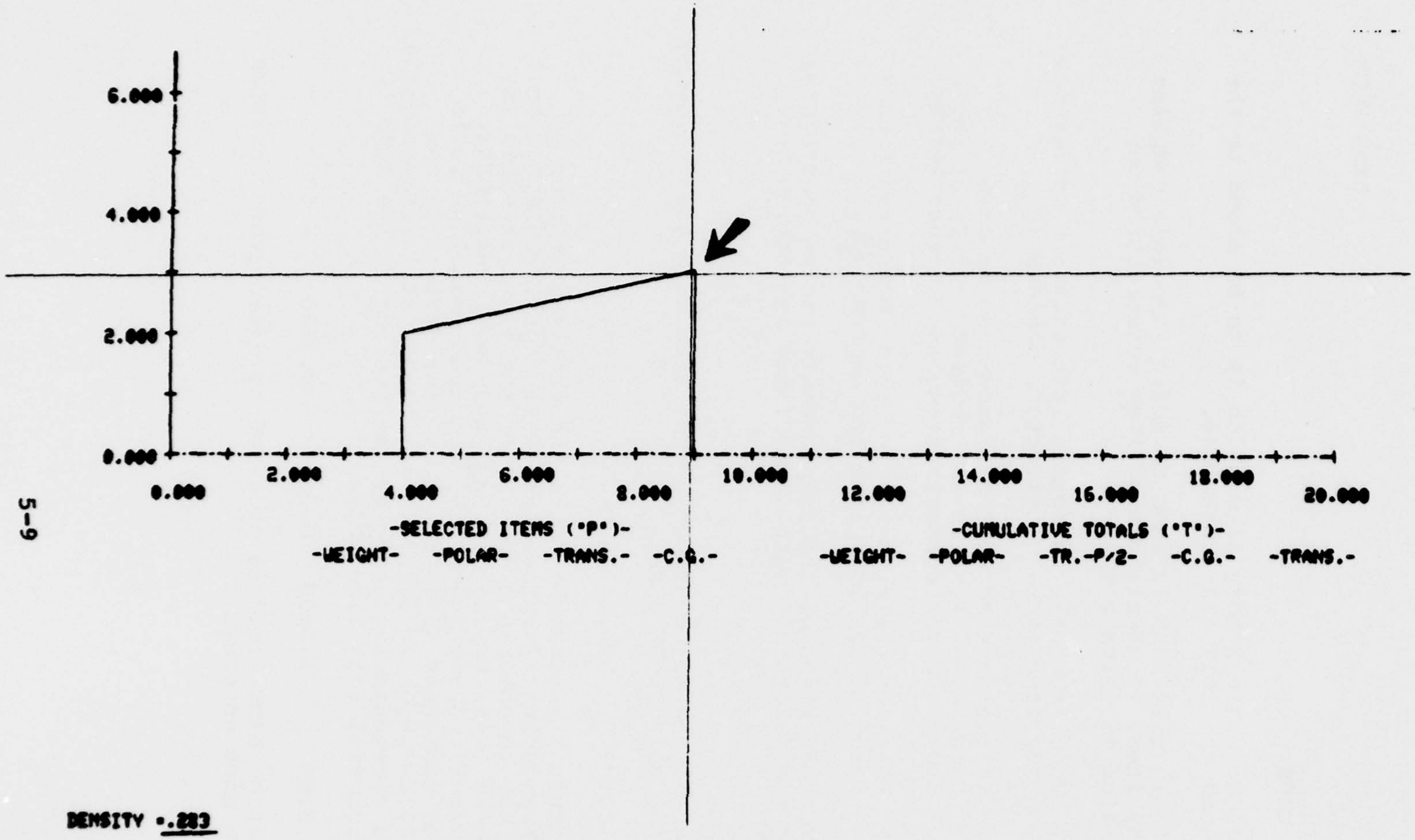


Figure 5-4. Completing a body item with a C keystroke.

5.3 Ⓒ GINK

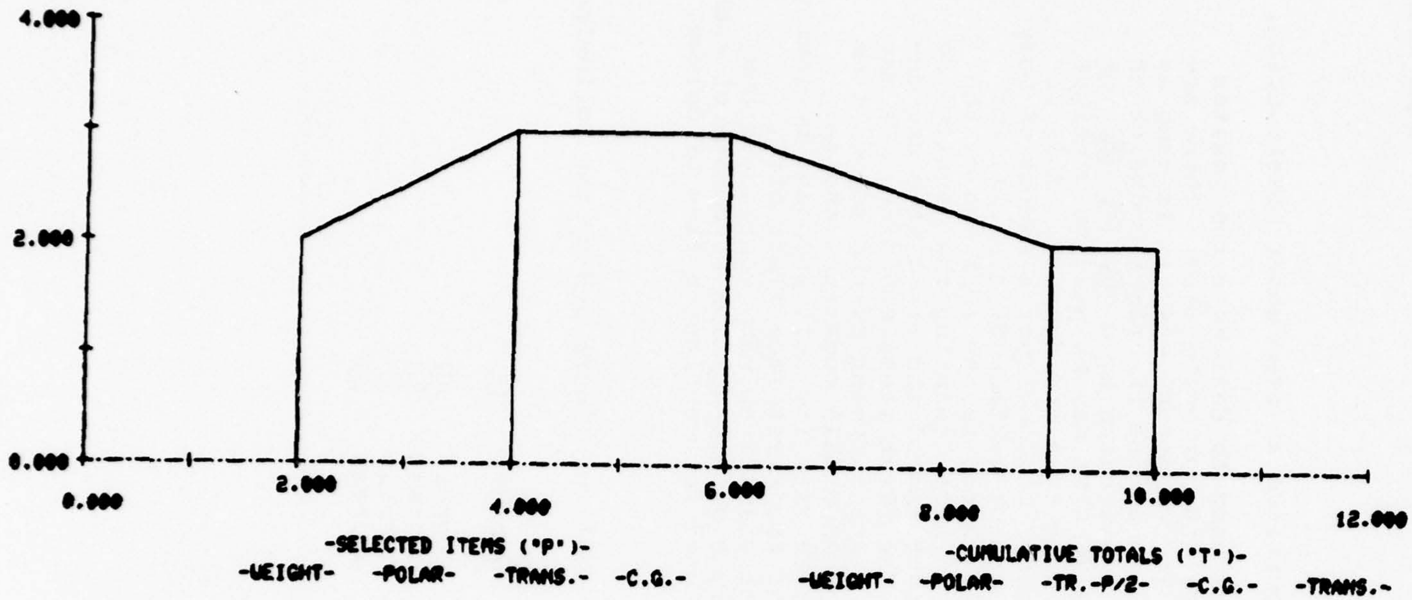
Purpose: To complete or continue an item under construction.

Discussion: The Ⓒ GINK is used to designate the positon of the right end of a body, fin, or ogive item. There are two ways it may be used. In the normal way, it is used as illustrated in section 5.2 to define the right endpoint of an item whose left end was designated by a Ⓑ, Ⓕ, Ⓞ, or Ⓖ GINK. Alternatively, a Ⓒ GINK may be used to continue constructing items of the same type and density. This is called the "shortcut" method. To construct a series of body items which describe the outside surface of a shell, for instance, user can move the cursor to the left end of the leftmost item and enter Ⓑ. After entering the density, he moves the cursor to the right end of the first item and depresses Ⓒ, which defines the first items endpoint. He may then move directly to the right endpoint of the second item and depress Ⓒ again, and PHASOR will construct another body item of the same density with its left endpoint beginning where the right endpoint of the first item "left off". Similarly, he can construct quickly as many contiguous body items as desired using only a single Ⓒ GINK to construct each. Similar operations may be used for continuing fins or ogives.

Example

User constructed the shell of figure 5-5 by the following sequence of GINKS:

Move cursor to	(2,2)	depress	Ⓑ
Enter density=.283			
Move cursor to	(4,3)	depress	Ⓒ
Move cursor to	(6,3)	depress	Ⓒ
Move cursor to	(9,2)	depress	Ⓒ
Move cursor to	(10,2)	depress	Ⓒ



DENSITY =.283

Figure 5-5. Continuing body items using © keystroke for "shortcut" method.

5.4 D GINK

Purpose: To begin an item of the same type as the last item, but with a new density.

Discussion: This GINK is available as a convenience. The item type is assumed to be carried over from the previous item type entered, but the prompting message for "DENSITY=" will be produced. For example, if user entered several body items of positive density using B and C GINKS, he could begin entering body items of a different density by moving the cursor to the left endpoint of the new item and depressing D.

Example

User has constructed the body item shown in figure 5-6. He now wishes to enter a "hollow" portion of the shell, so he moves the cursor to (5,1), the left endpoint of the hollow portion, and depresses D. PHASOR then prompts him to enter his new density, as shown. He may thereafter complete the item using a C GINK in the normal fashion.

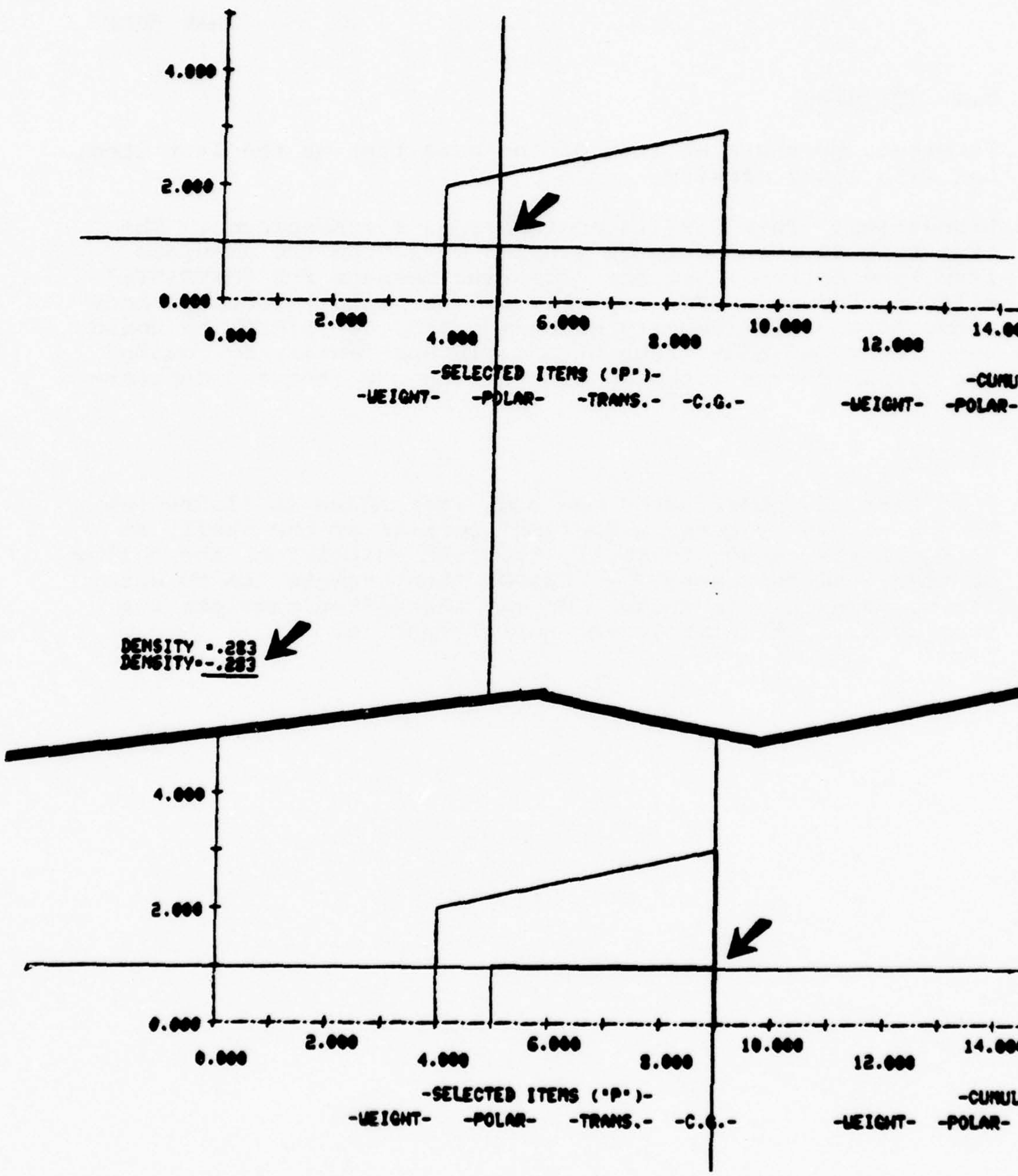


Figure 5-6. (a) Density change with D keystroke. (b) Completed item after C keystroke.

5.5 Ⓔ GINK

Purpose: To remove an item from the display and remove the associated data card from the EDIT file.

Discussion: The Ⓔ GINK provides an easy method for removing the unwanted items on a shell. The user can use the cross-hair cursors to "point" at the line representing the item to be removed and depress Ⓔ. Since the TEKTRONIX terminal cannot erase a line without erasing the entire screen, the line is not actually erased but crosshatched to indicate its removal. If desired, the entire shell may be redrawn with the item actually erased, by depressing Ⓡ after the Ⓔ GINK. If more than one item is under the cursor when the Ⓔ key is depressed, all of the indicated items are cross-hatched and their associated cards are removed from the EDIT file.

Example

User decides to modify the configuration of the shell shown in figure 5-7, by removing the body item from (4,3) to (6,4). To do so, he moves the crosshair cursor to the position shown in the figure and depresses Ⓔ . PHASOR then acknowledges the removal of the item by crosshatching the line under the cursor as shown. If user were to examine his data base in the EDIT file, he would find that the card which previously described this body item has been automatically removed by PHASOR.

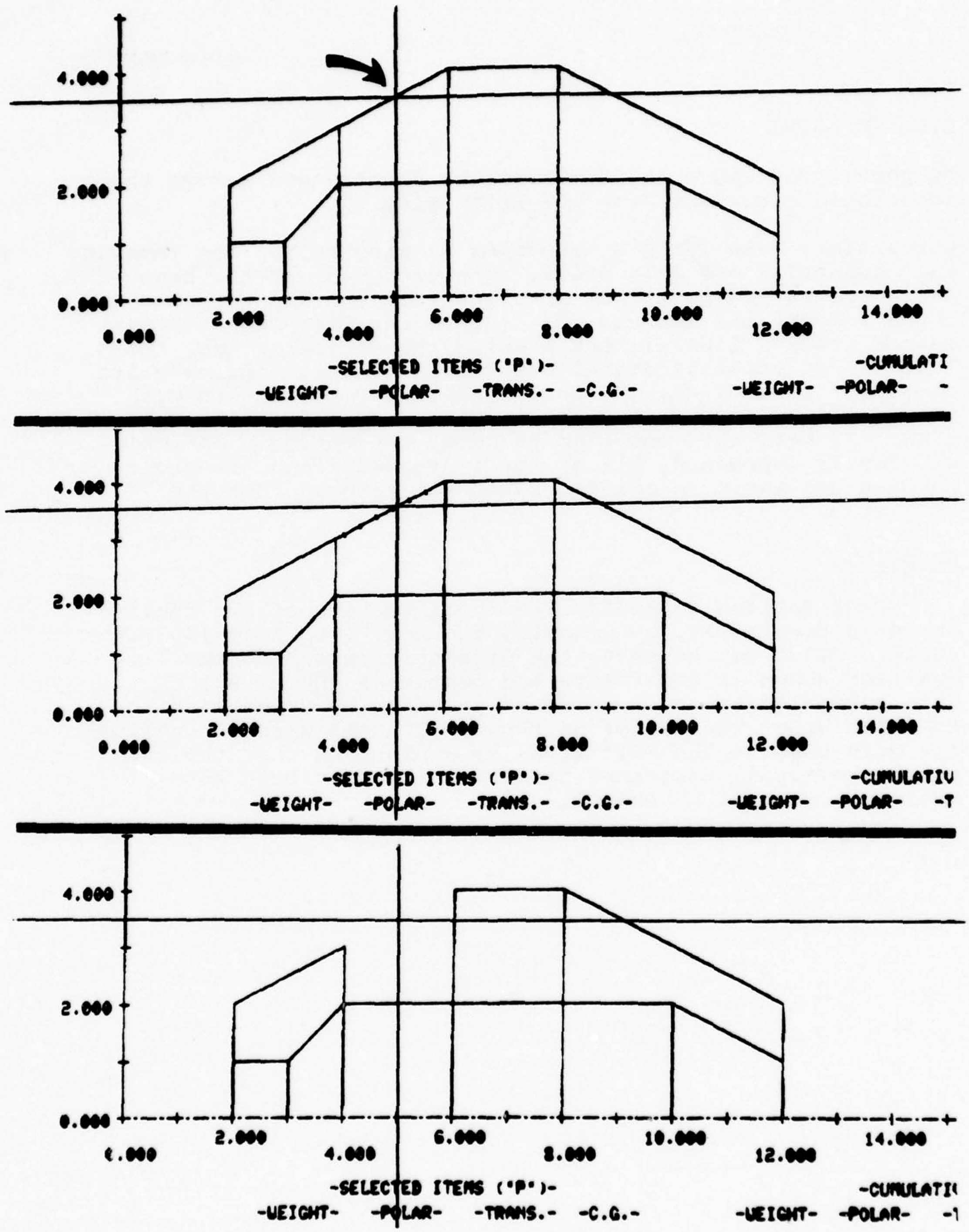


Figure 5-7. (a) "Erasing" item with E keystroke. (b) Redraw with R keystroke. (c) Final display after redraw.

5.6 Ⓕ GINK

Purpose: To begin a fin item which is to be displayed and added to the EDIT file data base.

Discussion: This GINK is used to define the left endpoint of a FIN item. A complete fin item may be constructed by the following steps:

(1) Move crosshair cursor to left endpoint of fin to be constructed, depress Ⓕ.

(2) In response to prompting message, "NUMBER OF FINS=", enter the number of symmetric fins around the shell (NFIN field on F data key; minimum NFIN is 2).

(3) In response to the prompting message, "DENSITY=", enter the desired density of the fin item.

(4) Move the crosshair cursor to the desired right endpoint of the item and depress Ⓒ.

(5) In response to the prompting message, "THICKNESS=", enter the thickness of each fin.

PHASOR will then draw the fin described and create the equivalent data card in the EDIT file data base.

Examples

User wishes to add the following fin to his simple shell of figure 5-8, using DRAW mode.

```
F,4
4.0,2.0,6.0,.1,2.,0.1
```

To do so, he moves the cursor to the position shown in figure 5-8 and depresses Ⓕ. He then enters the value of NFIN and density when prompted to do so, and moves the cursors to the position shown in figure 5-9 and depresses Ⓒ. Finally he enters the thickness of the fin when requested to do so. PHASOR automatically adds the card(s) needed to describe this item to the data base. User should bear in mind that fins always extend down all the way to the centerline of the shell, so in this case he will need to enter another fin with a density of -.1 form (2,2) to (8,2) in order to remove the part of the fin "inside" the body of the shell.

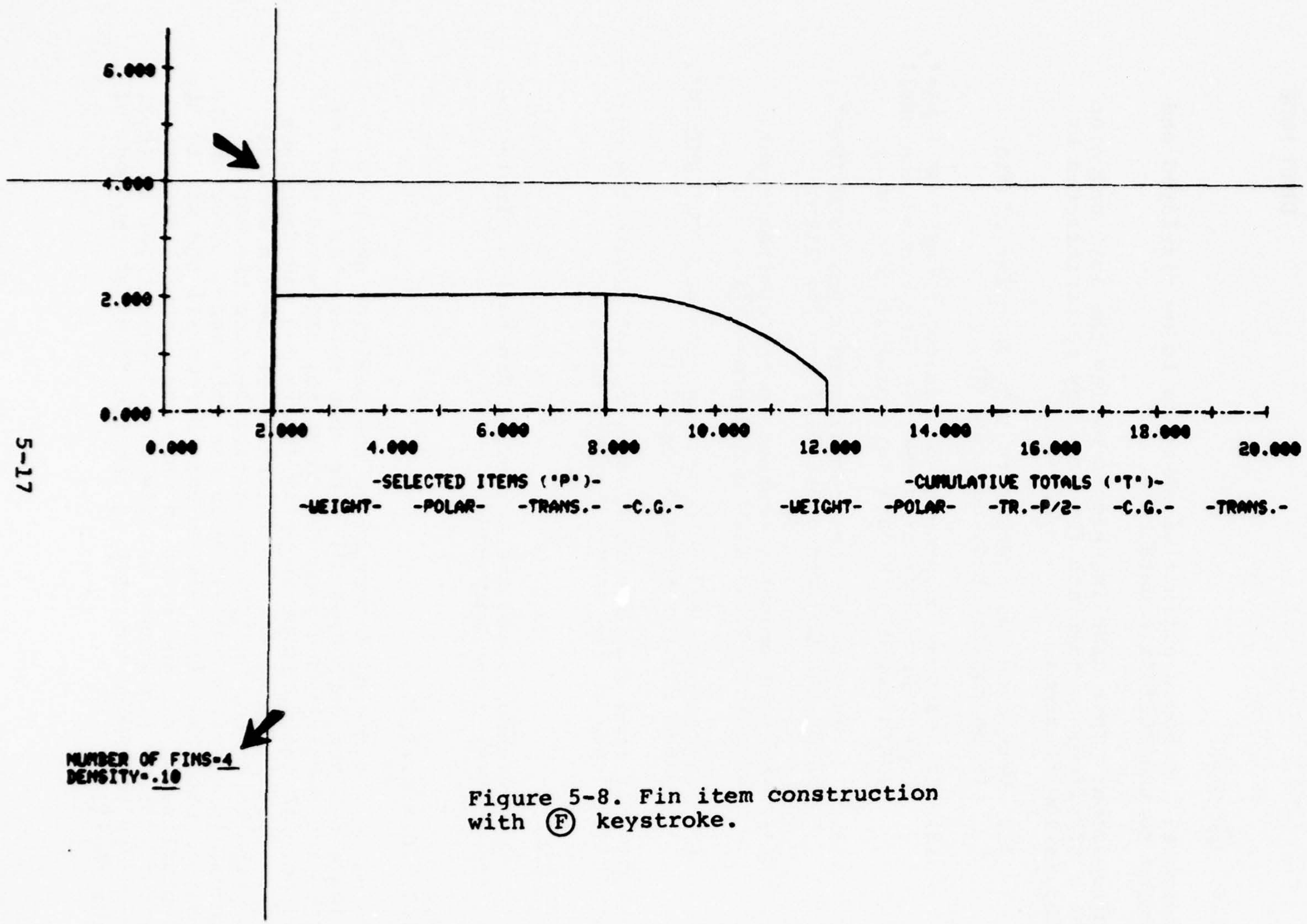
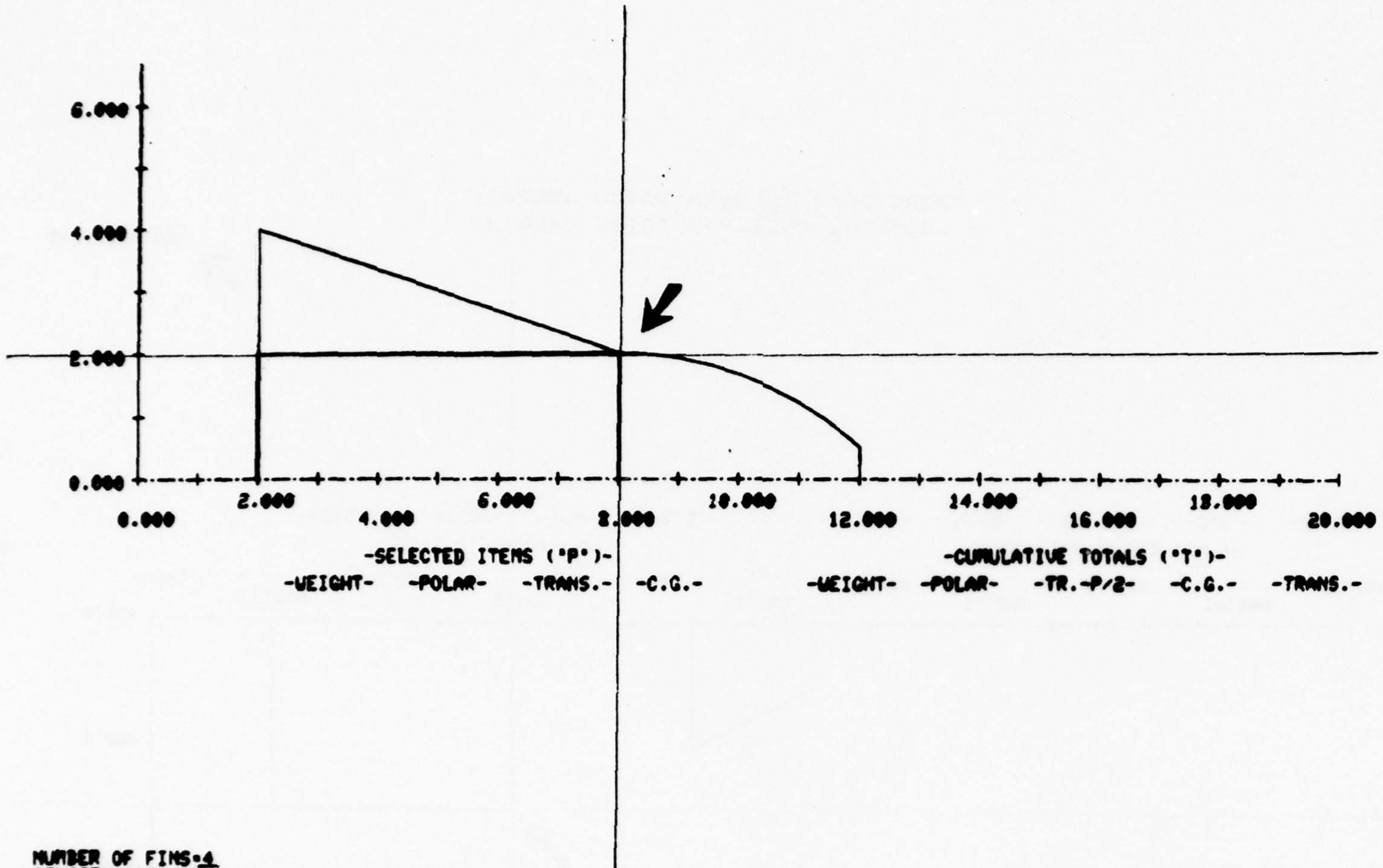


Figure 5-8. Fin item construction with F keystroke.



NUMBER OF FINS=4
DENSITY=.10
THICKNESS=.1

Figure 5-9. Completing fin item with C keystroke.

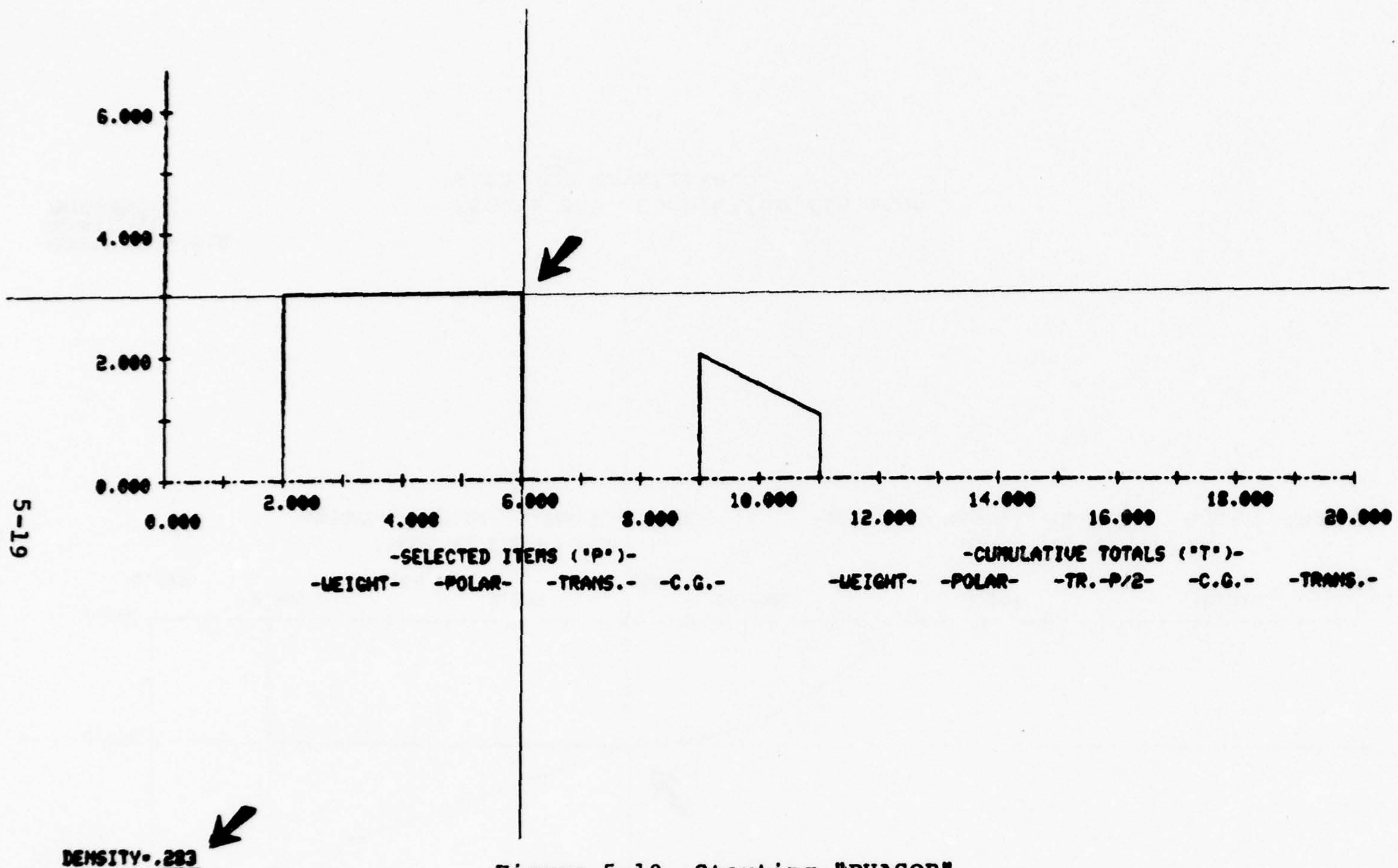


Figure 5-10. Starting "PHASOR" format ogive with G keystroke.

5.7 Ⓖ GINK

Purpose: To begin an ogive item using "PHASOR" format, which is to be displayed and added to the EDIT file data base.

Discussion: This GINK is used to define the left endpoint of an ogive item using PHASOR format. A complete ogive may be constructed by the following steps:

(1) Move cursor to left endpoint of ogive to be constructed, depress Ⓖ.

(2) In response to the prompting message , DENSITY=", type in the numeric value for the density of the ogive.

(3) Move the crosshair cursor to the right endpoint of the ogive and depress Ⓒ.

(4) In response to the prompting message, "RADIUS=", enter the numeric value for the radius of the ogive.

PHASOR will then draw the ogive described, and will create the corresponding data cards(s) in the EDIT file data base.

<u>Example</u>

User wishes to connect the two body items shown in figure 5-10 with an ogive having a radius of 6 inches. To do so, he moves the cursor to the starting point for the new ogive, (6,3), and depresses Ⓖ. He then enters the density of the ogive, as shown at the bottom of figure 5-10. To complete the ogive, user moves the cursor to the right end of the ogive, (9,2), and depresses Ⓒ. Finally, he enters the radius of the ogive. PHASOR then completes drawing the ogive as shown in figure 5-11.

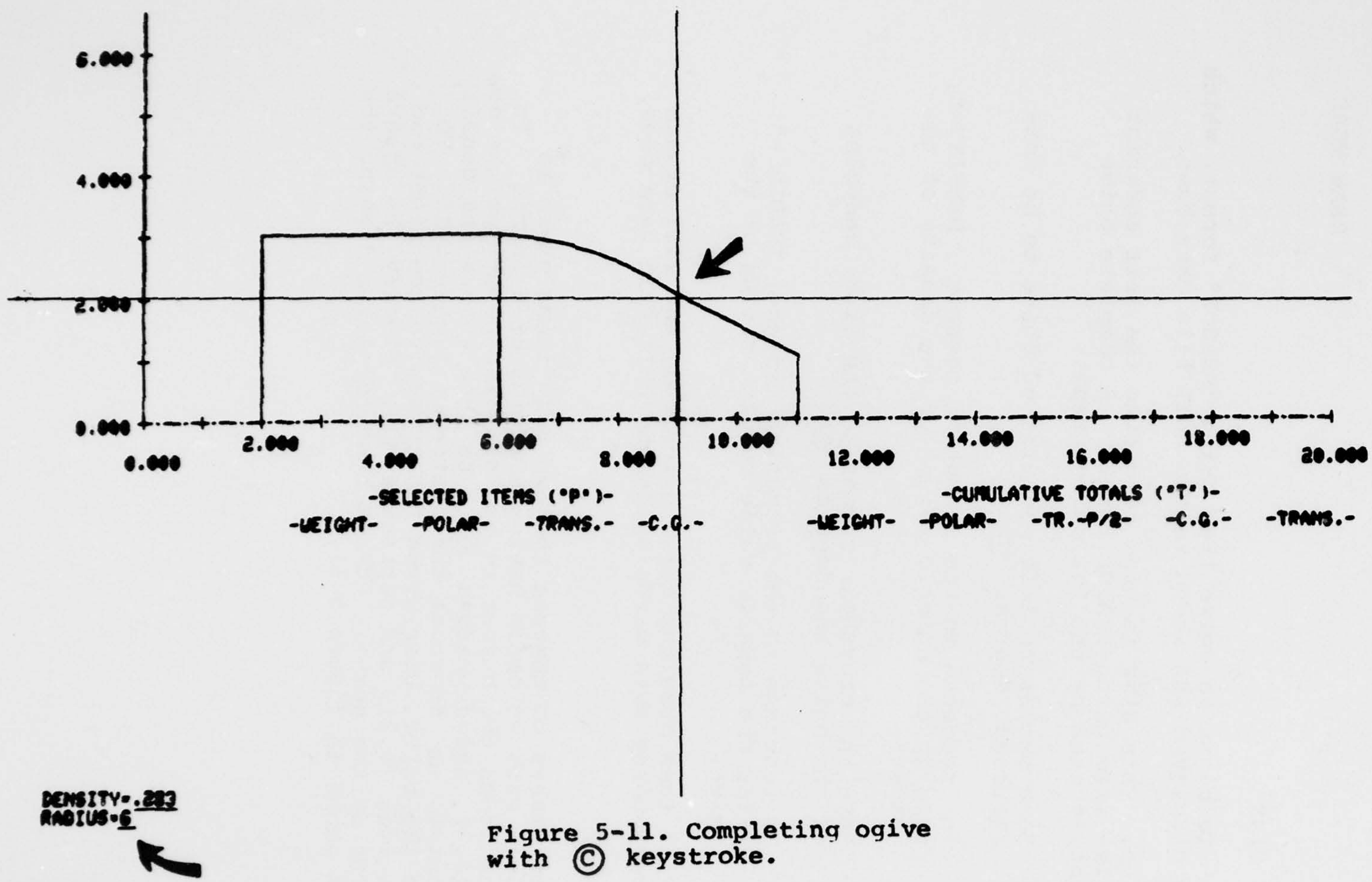


Figure 5-11. Completing ogive with © keystroke.

5.8 (H) GINK

Purpose: To display the total properties of the shell, including the outer volume, and produce on file OUTPUT a listing of the EDIT file, a listing of the individual properties of all items, and listings of the total properties of the shell, including outer volume.

Discussion: The (H) GINK differs from the (T) GINK in two respects. First, (T) does not display the total outer volume of the shell. Second, (T) does not produce any hardcopy output on the OUTPUT file. Because PHASOR has to do substantially more computation to compute the outer volume, the (H) GINK will require considerably longer time to complete than for (T).

Example

User wishes to save the properties of his shell for future printout. His present configuration of the shell is shown in figure 5-12. To do so, he depresses (H), and the resultant display is shown in figure 5-13. In addition, the hardcopy shown in figure 5-14 is automatically added to the OUTPUT file. The OUTPUT file may be displayed at a later time by going into PREVIEW mode, and/or may be diverted to a line printer for permanent retention.

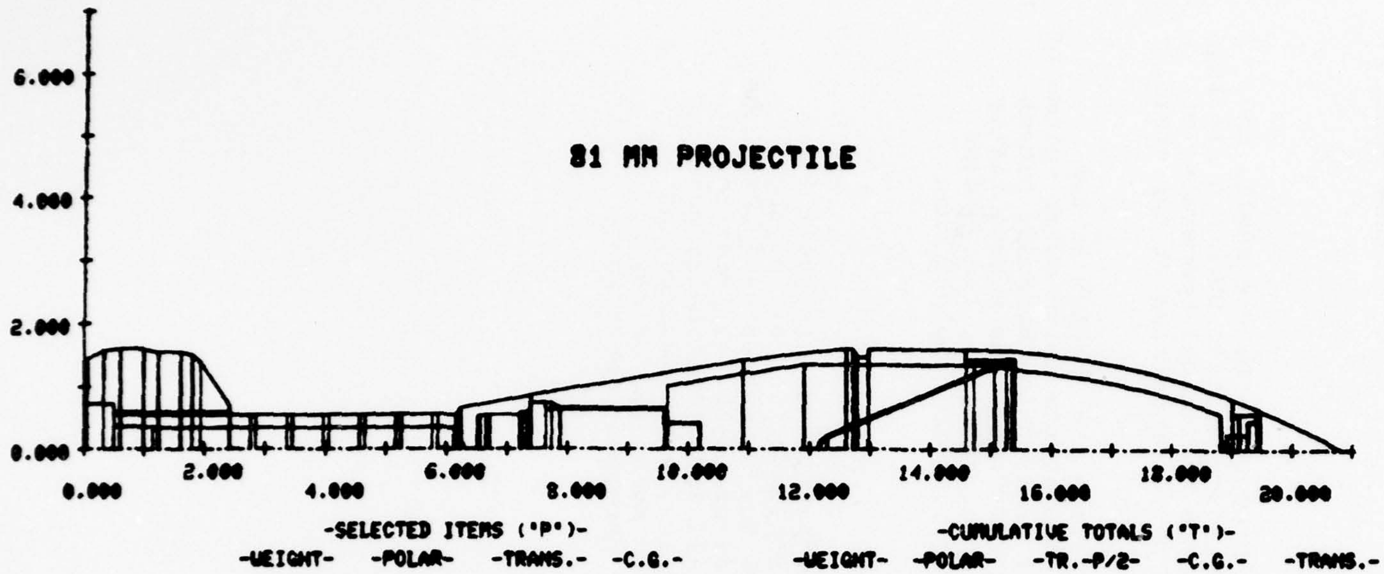


Figure 5-12. Sample projectile
for analysis.

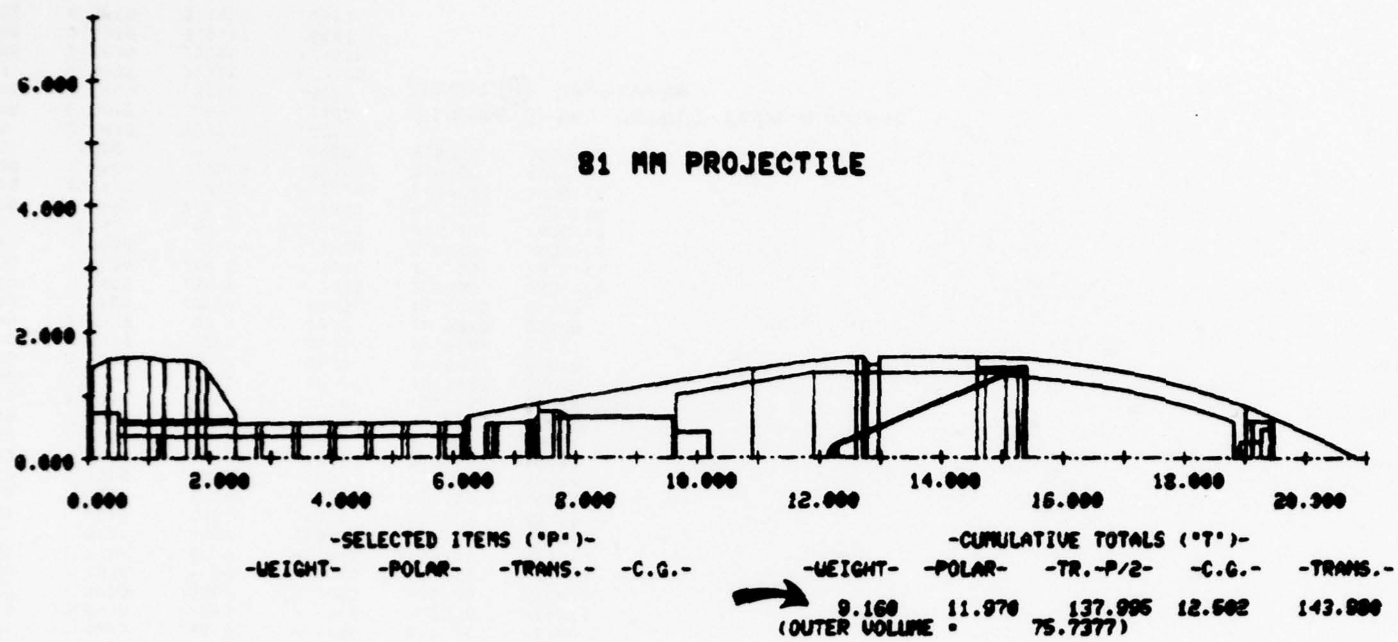


Figure 5-13. Displaying totals using (H) keystroke.

```
MAR 13, 1978      MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE  1

                                    PHASOR BEGUN AT  14.54.43.

PHASOR 1.0 REV. D

***** //ATTACH,DATA,PHASORDATA,CY=3,ID=CARBREY

PHASOR ATTACHED FILE DATA     TO CYCLE   3 OF PHASORDATA

***** //READ,DATA

PHASOR READS DATA SET   1 OF FILE DATA

T         81 MM BROM FROM PROMS DECK
W         -2         8          4.5        81 MM PROJECTILE
B
1.0925    1.0925     5.6450     .1000      .5000      FIN1
1.0925    1.1925     .05 0      .1000      6.1450     FIN2
1.3138    1.6842     1.1 31     .1000      6.2369     FIN4
.7126     .7126      .05 0      -.1000     .5000      -FIN5
.7126     .6850      .10 0      -.1000     1.1500     -FIN6
.6850     .6850      4.8750     -.1000     1.2500     -FIN7
.3464     0.0000     .10 0      -.1000     6.2100     -FIN9
1.0715    1.0920     .0950      -.1000     6.5450     -FIN11
1.0920    1.0920     .5550      -.1000     6.6400     -FIN12
1.1550    1.1550     .1150      -.1000     7.1950     -FIN13
1.1550    1.2750     .06 0      -.1000     7.3100     -FIN14
.9751     1.0851     .0550      .1000      6.6450     ADAP1
1.0851    1.0851     .5350      .1000      6.7000     ADAP2
1.0851    1.1206     .10 0      .1000      7.2350     ADAP3
1.1206    1.1906     .0350      .1000      7.3350     ADAP4
1.4552    1.4552     .25 0      .1000      7.3700     ADAP5
1.7079    2.7936     3.5 02     .2830      7.3700     BODY1
3.1695    3.1695     .1173      .2830      12.5660    BODY3
3.1695    2.9280     .0697      .2830      12.6833    BODY4
2.9280    2.9280     .1870      .2830      12.7530    BODY5
3.1695    3.1695     1.6 85     .2830      12.9400    BODY6
2.7910    2.7910     .1265      .2830      14.5585    BODY7
2.8299    2.8299     .54 0      .2830      14.6850    BODY8
2.8299    2.7608     .0950      .2830      15.2250    BODY9
1.4628    1.4628     .35 0      -.2830     7.3700     -BODY10
1.4628    1.3000     .14 0      -.2830     7.7200     -BODY11
1.3000    1.3000     1.7 20     -.2830     7.8610     -BODY12
.8250     .8250      .05 0      -.2830     9.5830     -BODY13
1.9900    2.6815     2.2 00     -.2830     9.6340     -BODY14
2.6815    2.6815     3.4 60     -.2830     11.8740    -BODY15
1.2500    1.2500     1.9630     .0830      7.6200     FUZE
.8000     .8000      .57 0      .0660      9.5830     BOOSTER
.4350     2.6815     2.7730     .3220
2.6815    2.6815     .2954      .3220
2.7600    2.7600     .0390      .3220
.3627     2.6035     2.7663     -.3220
2.6035    2.6035     .3265      -.3220
1.9900    2.6815     2.2 00     .0652
2.6815    2.6815     3.1506     .0652
```

Figure 5-14. OUTPUT file content after (H) keystroke.

```
.8250      .8250      .54 0      -.0652     9.6340     -OCTOL3
.4350      2.6815     2.7730     -.0652     12.2516    -OCTOL5
1.1100     1.1100     .10 0      .2830      18.9750    OGIVE2
1.1428     1.1428     .32 0      .2830      19.0850    OGIVE3
2.8380     2.8380     .6665      -.2830     14.5585    -OGIVE4
2.8750     2.8750     .13 0      -.2830     15.2250    -OGIVE5
.2500      .2500      .10 0      -.2830     18.7750    -OGIVE7
.5000      .5000      .35 0      -.2830     18.8750    -OGIVE8
.9200      .9200      .17 0      -.2830     19.2250    -OGIVE9
1.1502     1.1502     .40 0      -.0700     18.9750    -NOSE2
1.1875     1.1875     .05 0      -.0700     19.3750    -NOSE3
.4900      .4900      .35 0      .0700      18.8750    NOSE4
.9000      .9000      .17 0      .0700      19.2250    NOSE5
F          6
1.37       1.435      .0575      .1         0.         .1         FIN BL1
1.435      1.5675     .275       .1         .0575      .1         FIN BL2
1.5675     1.5925     .2750      .1         .3325      .1         FIN BL3
1.5925     1.5925     .3850      .1         .6075      .1         FIN BL4
1.5925     1.54       .25        .1         .9925      .1         FIN BL5
1.54       1.54       .37        .1         1.2425     .1         FIN BL6
1.54       1.4950     .19        .1         1.6125     .1         FIN BL7
1.495      1.375      .1350      .1         1.8025     .1         FIN BL8
1.375      .6875      .48        .1         1.9375     .1         FIN BL9
.7187      .7187      .5         -.1        0.         .1         -FIN BL10
.59        .59        1.9 75     -.1        .5         .1         -FIN BL11
.59        .59        1.9 75     .1         .5         .19        FIN BL12
.5462      .5462      1.9 75     -.1        .5         .19        -FIN BL13
.5462      .5462      .09 4      -.100      2.7548     .0904      -FIN HOL1
.3425      .3425      .09 4      .10        2.7548     .0904      FIN HOL1
.5462      .5462      .09 4      -.100      3.3548     .0904      -FIN HOL2
.3425      .3425      .09 4      .1         3.3548     .0904      FIN HOL2
.5462      .5462      .09 4      -.1000     3.9548     .0904      -FIN HOL3
.3425      .3425      .09 4      .1         3.9548     .0904      FIN HOL 3
.5462      .5462      .09 4      -.1        4.5548     .0904      -FIN HOL4
.3425      .3425      .09 4      .1         4.5548     .0904      FIN HOL 4
.5462      .5462      .09 4      -.1        5.1548     .0904      -FIN HOL 5
.3425      .3425      .09 4      .1         5.1548     .0904      FIN HOL 5
.5462      .5462      .09 4      -.1        5.7548     .0904      -FIN HOL 6
.3425      .3425      .09 4      .1         5.7548     .0904      FIN HOL 6
0
-.05       -.6075     .04 9      .1         6.1950     .0500      FIN3
0.         -.2575     .0850      -.1        6.125      .0850      - FIN 8
-.04       -.4957     .04        -.1        6.5050     .04        -FIN10
-3.0568    18.3682    1.6858     .283       10.8802    20.        BODY2
-.2347     0.         .1466      .3220      12.1050    .2347      LINER1
-.1957     0.         .12 2      -.3220     12.144     .1957      -LINER5
-.2347     0.         .1466      -.0652     12.1050    .2347      -OCTOL4
0.         11.4153    4.4 65     .283       14
.8005      11.4153    3.4 60     -.283      15
4.4165     11.4153    1.8        .07        18

END-OF-FILE DATA    AFTER  92 CARD IMAGES.

***** //DRAW,XMAX=10
```

Figure 5-14, continued. OUTPUT file content after (H) keystroke.

81 MM BROM FROM PROMS DECK

CARD TYPE DESCRIPTIVE FIELDS

1 TITLE 81 MM BROM FROM PROMS DECK

2 WRITE W SZ= -2.00 0 X = 8.0000 Y= 4.5000 81 MM PROJECTILE

4	BODY	D1= 1.09 5	D2= 1.0925	H= 5.6450	RHO= .1000	REF= .5000	ID=FIN1
5	BODY	1.09 5	1.1925	.0500	.1000	6.1450	FIN2
6	BODY	1.31 8	1.6842	1.1331	.1000	6.2369	FIN4
7	BODY	.71 6	.7126	.6500	-.1000	.5000	-FIN5
8	BODY	.71 6	.6850	.1000	-.1000	1.1500	-FIN6
9	BODY	.6850	.6850	4.8750	-.1000	1.2500	-FIN7
10	BODY	.3464	0.0000	.1000	-.1000	6.2100	-FIN9
11	BODY	1.07 5	1.0920	.0950	-.1000	6.5450	-FIN11
12	BODY	1.09 0	1.0920	.5550	-.1000	6.6400	-FIN12
13	BODY	1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
14	BODY	1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
15	BODY	.9751	1.0851	.0550	.1000	6.6450	ADAP1
16	BODY	1.0851	1.0851	.5350	.1000	6.7000	ADAP2
17	BODY	1.0851	1.1206	.1000	.1000	7.2350	ADAP3
18	BODY	1.12 6	1.1906	.0350	.1000	7.3350	ADAP4
19	BODY	1.4552	1.4552	.2500	.1000	7.3700	ADAP5
20	BODY	1.7079	2.7936	3.5102	.2830	7.3700	BODY1
21	BODY	3.1693	3.1695	.1173	.2830	12.5660	BODY3
22	BODY	3.1695	2.9280	.0697	.2830	12.6833	BODY4
23	BODY	2.9280	2.9280	.1870	.2830	12.7530	BODY5
24	BODY	3.1695	3.1695	1.6185	.2830	12.9400	BODY6
25	BODY	2.79 0	2.7910	.1265	.2830	14.5585	BODY7
26	BODY	2.8299	2.8299	.5400	.2830	14.6850	BODY8
27	BODY	2.8299	2.7608	.0950	.2830	15.2250	BODY9
28	BODY	1.46 8	1.4628	.3500	-.2830	7.3700	-BODY10
29	BODY	1.46 8	1.3000	.1410	-.2830	7.7200	-BODY11
30	BODY	1.30 0	1.3000	1.7220	-.2830	7.8610	-BODY12
31	BODY	.8250	.8250	.0510	-.2830	9.5830	-BODY13
32	BODY	1.99 0	2.6815	2.2400	-.2830	9.6340	-BODY14
33	BODY	2.68 5	2.6815	3.4460	-.2830	11.8740	-BODY15
34	BODY	1.25 0	1.2500	1.9630	.0830	7.6200	FUZE
35	BODY	.80 0	.8000	.5740	.0660	9.5830	BOOSTER
36	BODY	.4350	2.6815	2.7730	.3220	12.2516	LINER2
37	BODY	2.68 5	2.6815	.2954	.3220	15.0246	LINER3
38	BODY	2.76 0	2.7600	.0390	.3220	15.3200	LINER4
39	BODY	.36 7	2.6035	2.7663	-.3220	12.2662	-LINER6
40	BODY	2.60 5	2.6035	.3265	-.3220	15.0325	-LINER7
41	BODY	1.99 0	2.6815	2.2400	.0652	9.6340	OCTOL1
42	BODY	2.68 5	2.6815	3.1506	.0652	11.8740	OCTOL2
43	BODY	.8250	.8250	.5430	-.0652	9.6340	-OCTOL3
44	BODY	.4350	2.6815	2.7730			
45	BODY	1.11 0	1.1100	.1000			
46	BODY	1.14 8	1.1428	.3200			
47	BODY	2.8380	2.8380	.6665			
48	BODY	2.8750	2.8750	.1340			
49	BODY	.25 0	.2500	.1000			
50	BODY	.50 0	.5000	.3500			

Figure 5-14, continued. OUTPUT file content after H keystroke.

```
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                                  81 MM BROM FROM PROMS DECK

51 BODY     D1=    .92 0  D2=   .9200  H=    .1700  RHO=  -.2830  REF=  19.2250  ID=-OGIVE9
52 BODY           1.15 2       1.1502        .4000        -.0700        18.9750     -NOSE2
53 BODY           1.1875       1.1875        .0500        -.0700        19.3750     -NOSE3
54 BODY            .49 0        .4900        .3500         .0700        18.8750     NOSE4
55 BODY            .90 0        .9000        .1700         .0700        19.2250     NOSE5

57 FIN* 6   R1=   1.370   R2=  1.4350  H=    .0575  RHO=   .1000  REF=   0.0000  TH=   .1000  ID=FIN BL1
58 FIN* 6         1.4350       1.5675        .2750         .1000           .0575         .1000     FIN BL2
59 FIN* 6         1.5675       1.5925        .2750         .1000           .3325         .1000     FIN BL3
60 FIN* 6         1.59 5       1.5925        .3850         .1000           .6075         .1000     FIN BL4
61 FIN* 6         1.59 5       1.5400        .2500         .1000           .9925         .1000     FIN BL5
62 FIN* 6         1.54 0       1.5400        .3700         .1000          1.2425         .1000     FIN BL6
63 FIN* 6         1.54 0       1.4950        .1900         .1000          1.6125         .1000     FIN BL7
64 FIN* 6         1.4950       1.3750        .1350         .1000          1.8025         .1000     FIN BL8
65 FIN* 6         1.3750        .6875        .4800         .1000          1.9375         .1000     FIN BL9
66 FIN* 6          .7187        .7187        .5000        -.1000          0.0000         .1000     -FIN BL10
67 FIN* 6          .59 0        .5900       1.9175        -.1000           .5000         .1000     -FIN BL11
68 FIN* 6          .59 0        .5900       1.9175         .1000           .5000         .1900     FIN BL12
69 FIN* 6          .5462        .5462       1.9175        -.1000           .5000         .1900     -FIN BL13
70 FIN* 6          .5462        .5462        .0904        -.1000          2.7548         .0904     -FIN HOL1
71 FIN* 6          .34 5        .3425        .0904         .1000          2.7548         .0904     FIN HOL1
72 FIN* 6          .5462        .5462        .0904        -.1000          3.3548         .0904     -FIN HOL2
73 FIN* 6          .34 5        .3425        .0904         .1000          3.3548         .0904     FIN HOL2
74 FIN* 6          .5462        .5462        .0904        -.1000          3.9548         .0904     -FIN HOL3
75 FIN* 6          .34 5        .3425        .0904         .1000          3.9548         .0904     FIN HOL 3
76 FIN* 6          .5462        .5462        .0904        -.1000          4.5548         .0904     -FIN HOL4
77 FIN* 6          .34 5        .3425        .0904         .1000          4.5548         .0904     FIN HOL 4
78 FIN* 6          .5462        .5462        .0904        -.1000          5.1548         .0904     -FIN HOL 5
79 FIN* 6          .34 5        .3425        .0904         .1000          5.1548         .0904     FIN HOL 5
80 FIN* 6          .5462        .5462        .0904        -.1000          5.7548         .0904     -FIN HOL 6
81 FIN* 6          .34 5        .3425        .0904         .1000          5.7548         .0904     FIN HOL 6

83 OGIVE 0  A=    -.05 0  B=   -.6075  H=    .0419  RHO=   .1000  REF=   6.1950  R=    .0500  ID=FIN3
84 OGIVE 0         0.00 0       -.2575        .0850        -.1000          6.1250         .0850     - FIN 8
85 OGIVE 0         -.04 0       -.4957        .0400        -.1000          6.5050         .0400     -FIN10
86 OGIVE 0       -3.0568       18.3682       1.6858         .2830         10.8802       20.0000     BODY2
87 OGIVE 0        -.2317        0.0000        .1466         .3220         12.1050         .2347     LINER1
88 OGIVE 0        -.1957        0.0000        .1222        -.3220         12.1440         .1957     -LINER5
89 OGIVE 0        -.2317        0.0000        .1466        -.0652         12.1050         .2347     -OCTOL4
90 OGIVE 0         0.00 0      11.4153       4.4165         .2830         14.5585       13.0000     OGIVE 1
91 OGIVE 0          .80 5      11.4153       3.4160        -.2830         15.3590       12.7115     -OGIVE 6
92 OGIVE 0         4.4165      11.4153       1.8000         .0700         18.9750       13.0000     NOSE1
```

Figure 5-14, continued. OUTPUT file content after (H) keystroke.

81 MM BROM FROM PROMS DECK

CARD	TYPE	IDENTIFICATION	WEIGHT	POLAR	TRANSVERSE	C.G.	VOLUME
4	BODY	FIN1	.52917	.07895	1.40522	3.32250	5.29172
5	BODY	FIN2	.00513	.00084	.00000	6.17073	.05129
6	BODY	FIN4	.20099	.05788	.02116	6.84988	2.00986
7	BODY	-FIN5	-.02592	-.00165	-.00091	.82500	.25924
8	BODY	-FIN6	-.00384	-.00023	-.00000	1.19934	.03836
9	BODY	-FIN7	-.17966	-.01054	-.35581	3.68750	1.79658
10	BODY	-FIN9	-.00031	-.00000	-.00000	6.23500	.00314
11	BODY	-FIN11	-.00873	-.00128	-.00001	6.59280	.08731
12	BODY	-FIN12	-.05198	-.00775	-.00133	6.91750	.51979
13	BODY	-FIN13	-.01205	-.00201	-.00001	7.25250	.12049
14	BODY	-FIN14	-.00696	-.00129	-.00000	7.34099	.06962
15	BODY	ADAP1	.00459	.00061	.00000	6.67348	.04588
16	BODY	ADAP2	.04947	.00728	.00118	6.96750	.49475
17	BODY	ADAP3	.00955	.00145	.00001	7.28554	.09553
18	BODY	ADAP4	.00367	.00061	.00000	7.35285	.03672
19	BODY	ADAP5	.04158	.01101	.00022	7.49500	.41579
20	BODY	BODY1	4.02905	2.79568	3.89118	9.40194	14.23694
21	BODY	BODY3	.26191	.32889	.00030	12.62465	.92549
22	BODY	BODY4	.14407	.16783	.00006	12.71723	.50909
23	BODY	BODY5	.35634	.38187	.00104	12.84650	1.25914
24	BODY	BODY6	3.61385	4.53797	.78889	13.74925	12.76980
25	BODY	BODY7	.21902	.21326	.00029	14.62175	.77393
26	BODY	BODY8	.96120	.96220	.02336	14.95500	3.39645
27	BODY	BODY9	.16500	.16121	.00012	15.27211	.58305
28	BODY	-BODY10	-.16646	-.04452	-.00170	7.54500	.58820
29	BODY	-BODY11	-.05987	-.01436	-.00010	7.78773	.21157
30	BODY	-BODY12	-.64684	-.13664	-.15984	8.72200	2.28565
31	BODY	-BODY13	-.00772	-.00066	-.00000	9.60850	.02726
32	BODY	-BODY14	-2.73614	-1.93378	-1.11776	10.86372	9.66832
33	BODY	-BODY15	-5.50741	-4.95009	-5.45000	13.59700	19.46080
34	BODY	FUZE	.19994	.03905	.06420	8.60150	2.40896
35	BODY	BOOSTER	.01904	.00152	.00052	9.87000	.28852
36	BODY	LINER2	1.99776	1.08186	.78698	14.20603	6.20422
37	BODY	LINER3	.53717	.48281	.00391	15.17230	1.66823
38	BODY	LINER4	.07513	.07154	.00001	15.33950	.23333
39	BODY	-LINER6	-1.83155	-.93357	-.68996	14.23461	5.68803
40	BODY	-LINER7	-.55969	-.47421	-.00497	15.19575	1.73815
41	BODY	OCTOL1	.63037	.44552	.2[illegible]752	10.86372	9.66832
42	BODY	OCTOL2	1.16008	1.04268	.95960	13.44930	17.79257
43	BODY	-OCTOL3	-.01893	-.00161	-.00047	9.90550	.29027
44	BODY	-OCTOL5	-.40452	-.21906	-.15935	14.20603	6.20422
45	BODY	OGIVE2	.02739	.00422	.00002	19.02500	.09677
46	BODY	OGIVE3	.09289	.01516	.00079	19.24500	.32823
47	BODY	-OGIVE4	-1.19317	-1.20126	-.04417	14.89175	4.21614
48	BODY	-OGIVE5	-.24618	-.25436	-.00037	15.29200	.86990
49	BODY	-OGIVE7	-.00139	-.00001	-.00000	18.82500	.00491
50	BODY	-OGIVE8	-.01945	-.00061	-.00020	19.05000	.06872
51	BODY	-OGIVE9	-.03198				.11301
52	BODY	-NOSE2	-.02909				.41562
53	BODY	-NOSE3	-.00388				.05538
54	BODY	NOSE4	.00462				.06600
55	BODY	NOSE8	.00757				.10815

Figure 5-14, continued. OUTPUT file content after H keystroke.

81 MM BROM FROM PROMS DECK

CARD	TYPE	IDENTIFICATION	WEIGHT	POLAR	TRANSVERSE	C.G.	VOLUME
57	FIN	FIN BL1	.00484	.00317	.00000	.02897	.04839
58	FIN	FIN BL2	.02477	.01865	.00016	.19702	.24771
59	FIN	FIN BL3	.02607	.02170	.00016	.47036	.26070
60	FIN	FIN BL4	.03679	.03110	.00045	.80000	.36787
61	FIN	FIN BL5	.02349	.01922	.00012	1.11680	.23494
62	FIN	FIN BL6	.03419	.02703	.00039	1.42750	.34188
63	FIN	FIN BL7	.01730	.01328	.00005	1.70703	.17300
64	FIN	FIN BL8	.01162	.00799	.00002	1.86906	.11624
65	FIN	FIN BL9	.02970	.01170	.00055	2.15083	.29700
66	FIN	-FIN BL10	-.02156	-.00371	-.00045	.25000	.21561
67	FIN	-FIN BL11	-.06788	-.00788	-.02080	1.45875	.67880
68	FIN	FIN BL12	.12897	.01496	.03952	1.45875	1.28971
69	FIN	-FIN BL13	-.11940	-.01187	-.03658	1.45875	1.19397
70	FIN	-FIN HOL1	-.00268	-.00027	-.00000	2.80000	.02678
71	FIN	FIN HOL1	.00168	.00007	.00000	2.80000	.01679
72	FIN	-FIN HOL2	-.00268	-.00027	-.00000	3.40000	.02678
73	FIN	FIN HOL2	.00168	.00007	.00000	3.40000	.01679
74	FIN	-FIN HOL3	-.00268	-.00027	-.00000	4.00000	.02678
75	FIN	FIN HOL 3	.00168	.00007	.00000	4.00000	.01679
76	FIN	-FIN HOL4	-.00268	-.00027	-.00000	4.60000	.02678
77	FIN	FIN HOL 4	.00168	.00007	.00000	4.60000	.01679
78	FIN	-FIN HOL 5	-.00268	-.00027	-.00000	5.20000	.02678
79	FIN	FIN HOL 5	.00168	.00007	.00000	5.20000	.01679
80	FIN	-FIN HOL 6	-.00268	-.00027	-.00000	5.80000	.02678
81	FIN	FIN HOL 6	.00168	.00007	.00000	5.80000	.01679
83	OGIVE	FIN3	.00547	.00114	.00000	6.21634	.05473
84	OGIVE	- FIN 8	-.00282	-.00015	-.00000	6.16492	.02817
85	OGIVE	-FIN10	-.00349	-.00049	-.00000	6.52536	.03493
86	OGIVE	BODY2	3.38959	3.85277	.79429	11.75806	11.97734
87	OGIVE	LINER1	.00404	.00007	.00001	12.19952	.01255
88	OGIVE	-LINER5	-.00234	-.00003	-.00000	12.22279	.00727
89	OGIVE	-OCTOL4	-.00082	-.00001	-.00000	12.19952	.01255
90	OGIVE	OGIVE 1	7.15355	7.17120	9.87508	16.37023	25.27757
91	OGIVE	-OGIVE 6	-3.19560	-1.91264	-2.58697	16.70291	11.29186
92	OGIVE	NOSE1	.09623	.01971	.01249	19.45285	1.37478

PHASOR DETERMINED OUTER VOLUME WAS COMPRISED OF FOLLOWING EDIT FILE CARDS...

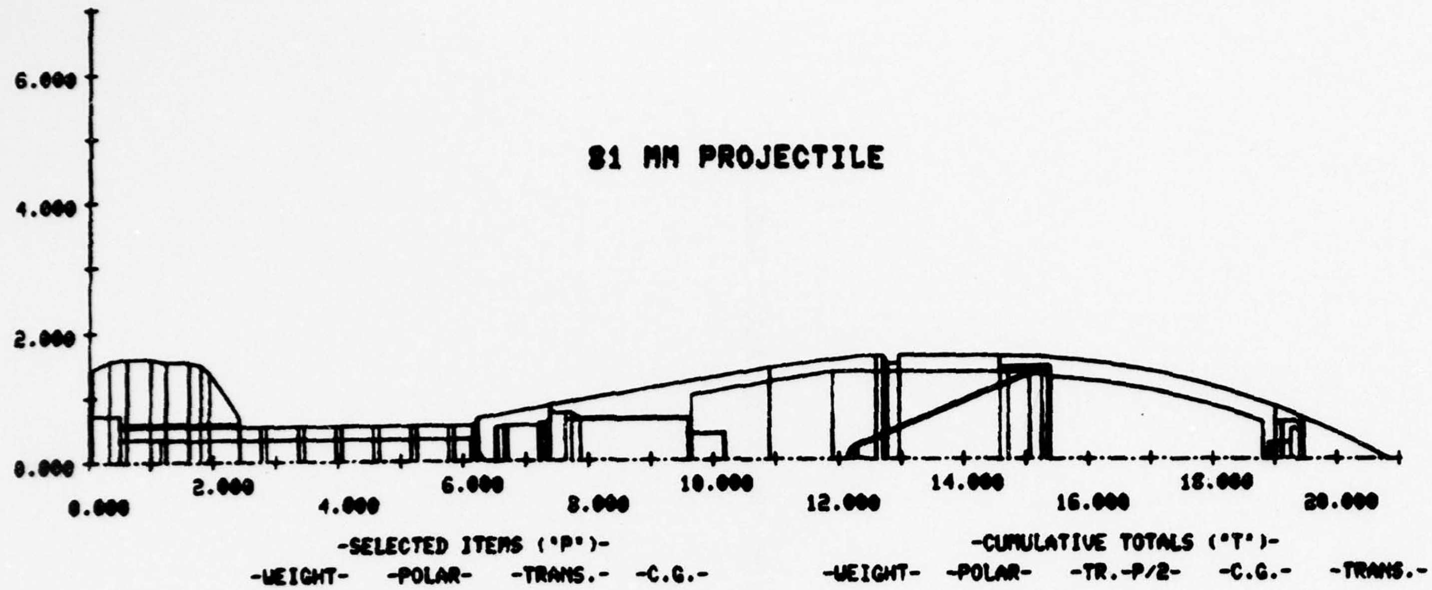
4 5 83 6 20 86 21 22 23
90 92

Figure 5-14, continued. OUTPUT file content after H keystroke.

```
MAR 13, 1978      MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE 7
                                   81 MM BROM FROM PROMS DECK
    TOTAL PROPERTIES FOR  52 BODY ITEMS, 25 FIN ITEMS,  0 KNOWN ITEMS, AND  10 OGIVE ITEMS...

               WEIGHT=                          9.1596
               POLAR INERTIA =                 11.9702
               TRANSVERSE - POLAR/2 =         137.9950
               CENTER OF GRAVITY =             12.5021
               TRANSVERSE INERTIA =           143.9801
               OUTER VOLUME =                  75.7377
```

Figure 5-14, continued. OUTPUT file content after H keystroke.



WEIGHT, POLAR, TRANS-P/2, CG, VOLUME =0.664, .5533,1.02, 18.1,0

Figure 5-15. Known item entry after (K) keystroke.

5.9 Ⓚ GINK

Purpose: To enter a known item into the EDIT file data base.

Discussion: The position of the crosshair cursor is of no consequence for Ⓚ GINKS. All information is entered via the keyboard. When Ⓚ is depressed, PHASOR will prompt,

"WEIGHT, POLAR, TRANS-P/2, CG, VOLUME="

User should then enter the numeric values for these five fields, all on one line, separated by commas. The "TRANS-P/2" field is the Planar transverse, T' of section 1.2. If the volume is unknown or not of interest, enter it as 0. Naturally, PHASOR cannot draw the known item since it has no idea what it looks like. The total properties of the shell will reflect the added known item, however.

<u>Example</u>

User wishes to add a cup to the inside of his 81 MM projectile pictured in figure 5-15. In terms of the scale shown, the C.G. of the cup is 18.1 inches. The other properties of the cup are weight=0.664, polar=.5533, T'=1.02. User does not care about the volume. To enter the cup as a known item, user depresses Ⓚ, and in response to the prompting message, enters the data fields as shown in figure 5-15. PHASOR will automatically generate a known item data card in the EDIT file with these fields.

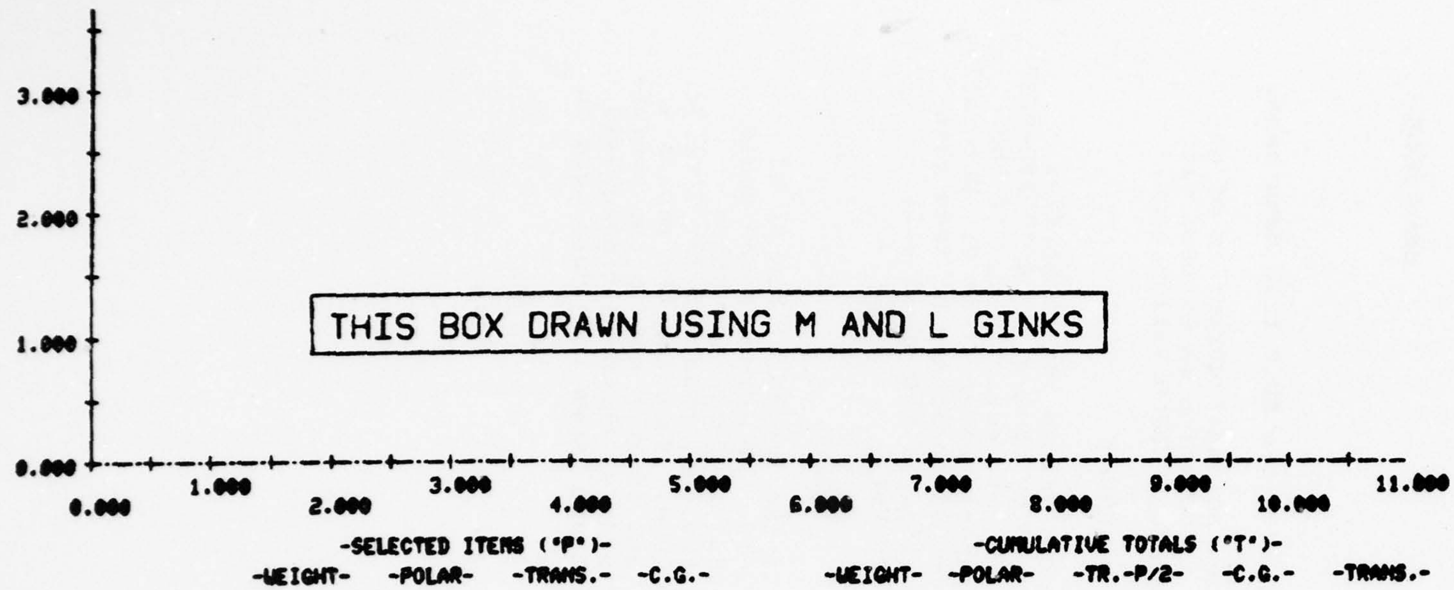
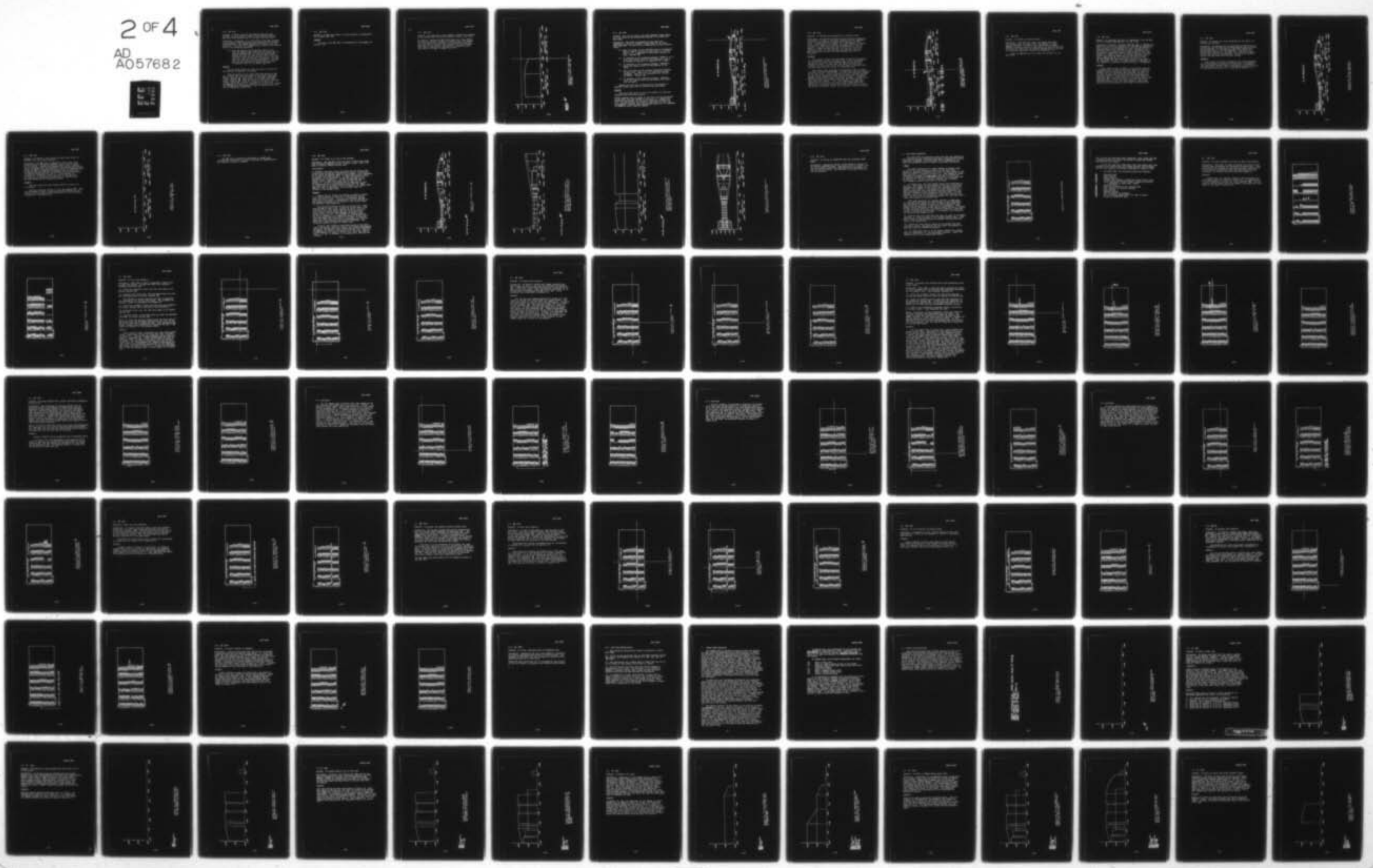


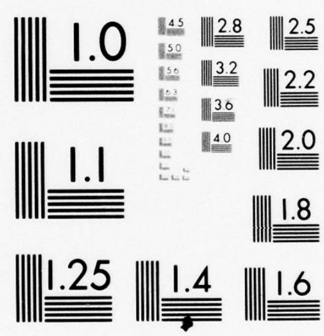
Figure 5-16. Constructing a box using M and L keystrokes.

AD-A057 682 ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND DOVER--ETC F/G 12/1
PHASOR PHYSICAL ANALYSIS OF SOLIDS OF REVOLUTION, USER MANUAL.(U)
APR 78 B D CARBREY

UNCLASSIFIED MISD-UM-78-4 NL

2 OF 4
AD
A057682





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

5.10 L GINK

Purpose: To draw a line on the display from the last location of the crosshair cursor to the present location, and add a line-drawing card to the EDIT file data base.

Discussion: Frequently it is desirable to add some linework to the display without altering the properties of the shell being analyzed. The M and L GINKS are provided for this function. A straight line segment may be drawn in the display area by the following procedure:

(1) Move the cursor to the starting point of the line and depress M. Then move the cursor to the desired endpoint for the line and depress L. PHASOR will add the line to the display and will generate a data card in the EDIT file to draw the line each time the display is generated. If user does not wish the line to become part of the data base, he can suppress data base entry by using the S GINK prior to the M and L GINKS.

Example

The box drawn around the text in figure 5-16 was produced using the L GINK, as follows:

Move the cursor to the lower left-hand corner of the box, depress M. Move the cursor to the lower right-hand corner, depress L. Move cursor to the upper right-hand corner, depress L. Move cursor to the upper left-hand corner, depress L. Move the cursor to the lower left-hand corner, depress L. PHASOR will generate 4 data cards corresponding to these line segments in the EDIT file, unless the S GINK has been previously used to suppress EDIT file entry of M, L, A and W GINKS.

5.11 Ⓜ GINK

Purpose: To move the cursor to a new location in preparation for an Ⓐ or Ⓛ GINK.

Example

The use of the Ⓜ GINK is illustrated in the example of section 5.10.

5.12 Ⓝ GINK

Purpose: To erase the current display, discard the contents of the current EDIT file, and prepare to start a new shell.

Discussion: Depressing Ⓝ in draw mode will cause PHASOR to erase the screen, re-draw the default axes, and prepare for a new shell to be entered. Any previously displayed item will not be redrawn, and the EDIT file will be empty. This GINK is equivalent to returning to DIRECTIVE mode, and entering the <u>NEW</u> and <u>DRAW</u> directives.

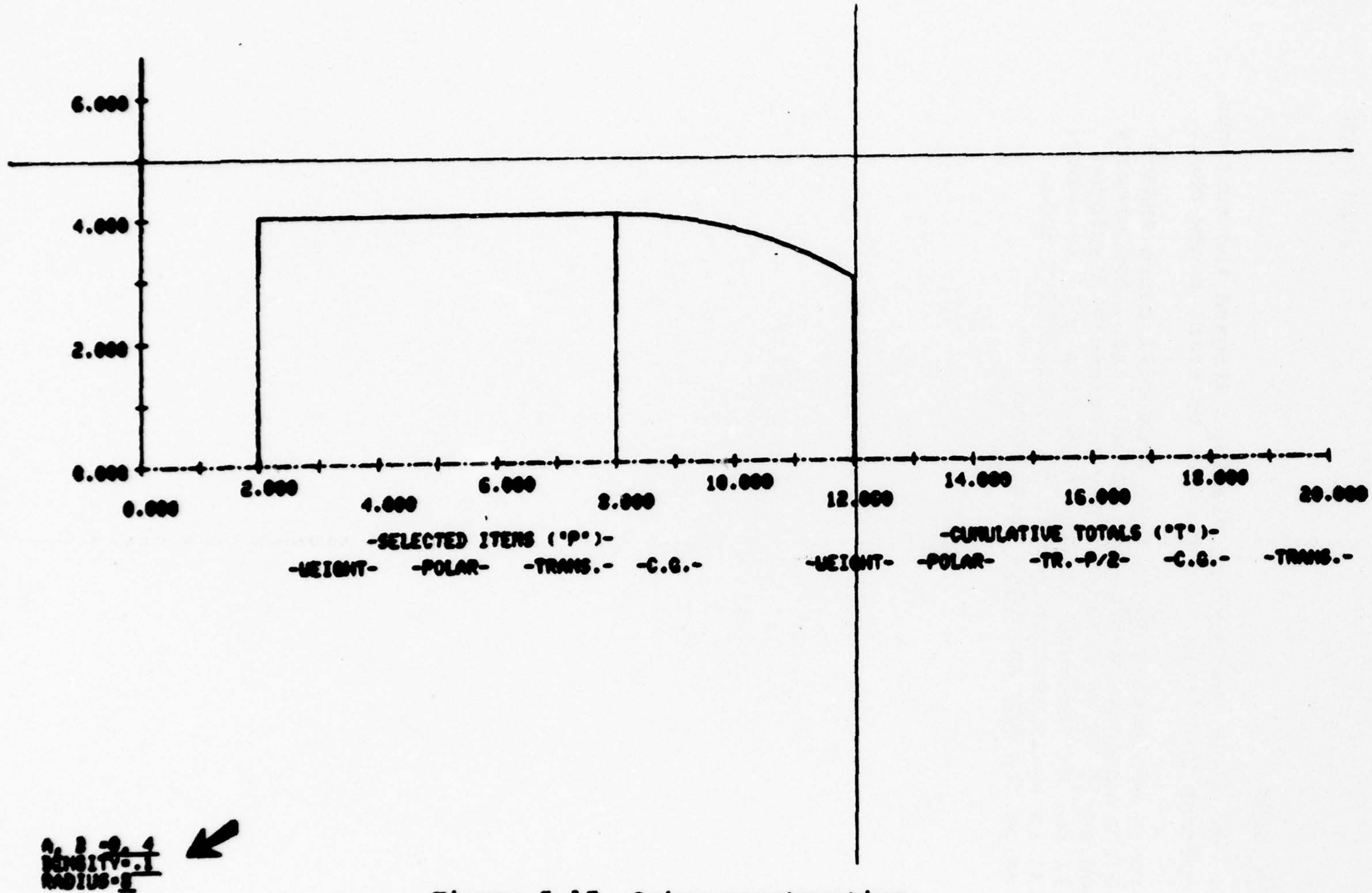


Figure 5-17. Ogive construction ("WEIGHT" format) after O keystroke.

5.13 Ⓞ GINK

Purpose: To begin an ogive item using "WEIGHT" format which is to be drawn on the display and entered in the EDIT file data base.

Discussion: This GINK is provided to give users the capability of entering "WEIGHT" format data for an ogive from DRAW mode. An ogive may be constructed by the following steps:

(1) Move the cursor to the left-hand end of the desired ogive. The "Y" position of the cursor is ignored. Only the "X" coordinate of the cursor location is used. Depress Ⓞ.

(2) In response to the prompting message, "ENTER A, B =", enter the numeric value for the distances A and B, as defined in section 3.6, separated by a comma.

(3) In response to the prompting message, "DENSITY=", enter the numeric value for the density of the ogive.

(4) Move the cursor to the desired right-hand endpoint of the ogive. Again, the "Y" coordinate may be anywhere; only the "X" coordinate will be used by PHASOR. Depress Ⓒ.

(5) In response to the prompting message, "RADIUS=", enter the numeric value of the radius to be used for the ogive.

PHASOR will draw the indicated ogive and generate a "WEIGHT" format data card in the EDIT file data base.

Example

The ogive from (8,4) to (12,3) of figure 5-17 was generated by the following actions:

PHASOR prompted user as shown on the first line at the bottom of the page, and user entered A and B as 0,4. PHASOR then asked for the density of the ogive, which user supplied as 0.1. User then moved the cursor to position (12, any) and depressed Ⓒ. Finally, user entered the radius as 8 in response to PHASOR's final prompting message.

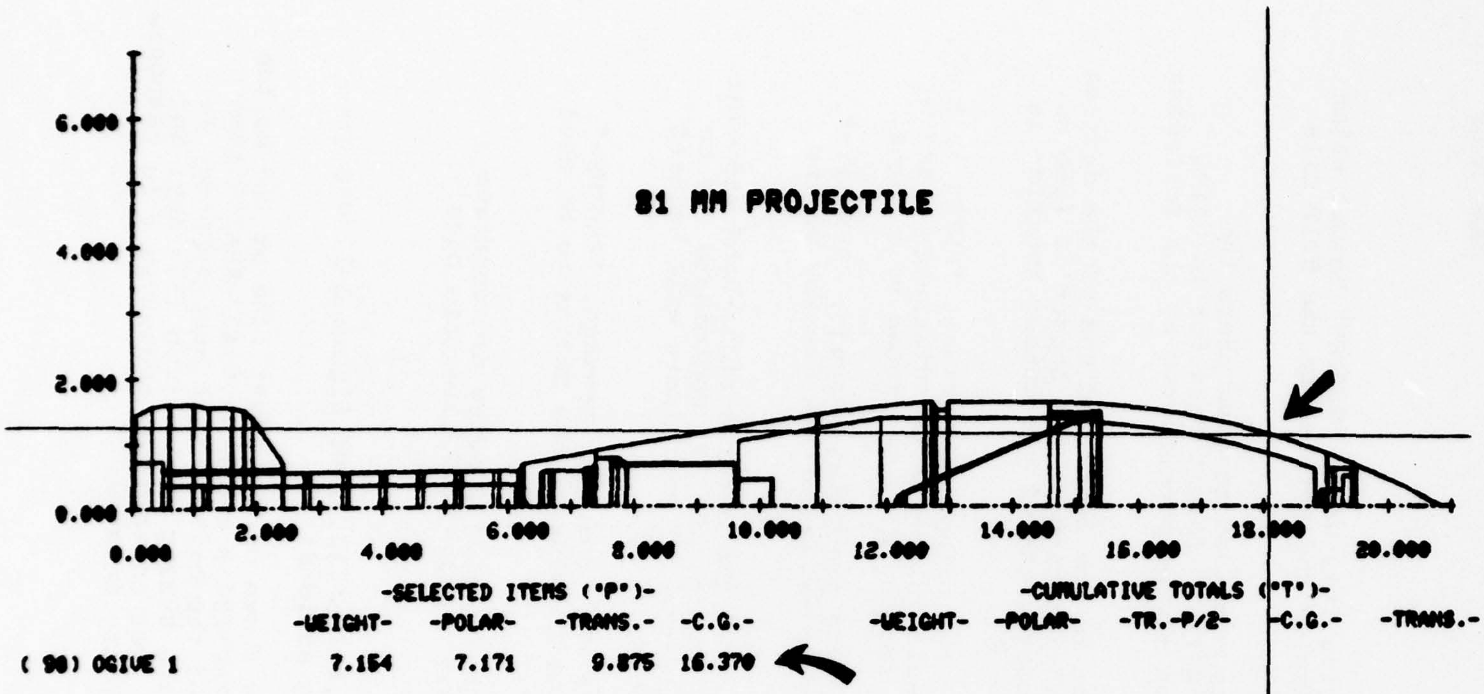


Figure 5-18. Properties display for item picked using P keystroke.

5.14 Ⓟ GINK

Purpose: To display the properties of a selected item.

Discussion: The Ⓟ GINK provides the user with the capability to "point at" a part of the shell outline with the crosshair cursor and tell PHASOR to display the properties of that item. In addition to the weight, C.G., and moments of inertia of the item, PHASOR will display the number of the card on the EDIT file which describes the item pointed at, and its NAME, if a NAME has been assigned. In the event that the crosshair cursor is "pointing at" more than one item when Ⓟ is depressed, then all the items "pointed at" will be displayed.

Example

User wishes to know the properties of the ogive indicated by the crosshair cursors in figure 5-18. Having positioned the cursors as shown, user depresses Ⓟ, and the resulting display is shown. In this case, the ogive indicated was described on card number 90 in the data base on the EDIT file, and had a NAME field of "OGIVE 1" on the data card.

Now suppose user positions the crosshair cursor as shown in figure 5-19 and depresses Ⓟ . In this case, the line "pointed at" by the cursor is really representing two coincident surfaces of two items; the inside surface of the shell, and the outside surface of the explosive filler inside the shell. Therefore, PHASOR displays both items' properties, as shown in figure 5-19. The first item is card number 32 on the EDIT file and has a name field of "-BODY14   0". The second item, which has a weight of 0.630, is the 41st card on the current EDIT file. Notice that the weight of the item on the 32nd card is -2.736. The weight is negative because this item has a negative density.

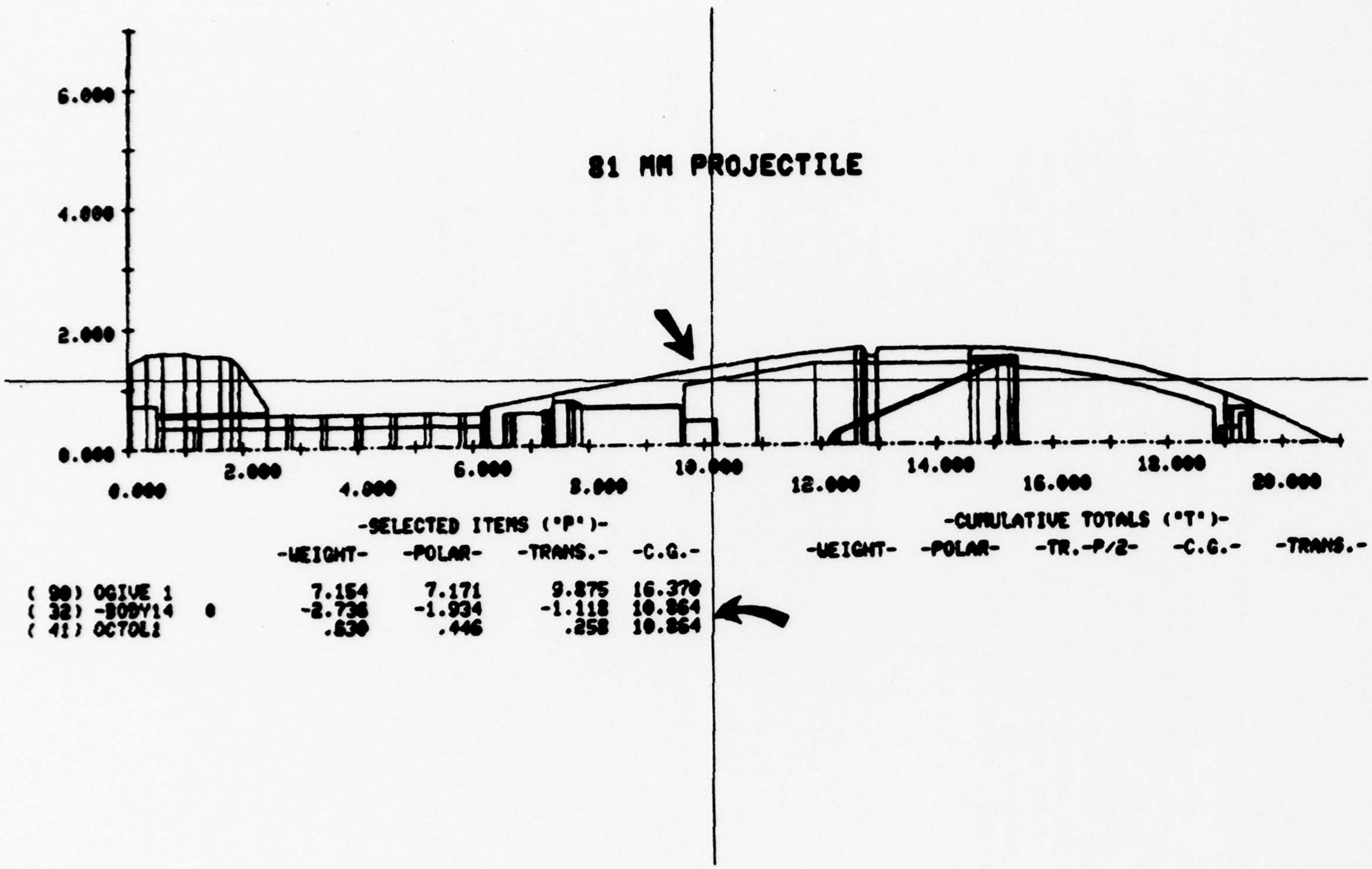


Figure 5-19. Properties of two coincident surfaces displayed using P keystroke.

5.15 Ⓡ GINK

Purpose: To redraw an existing shell.

Discussion: This GINK will erase the screen and redraw the display using the same scale. The Ⓡ GINK is most commonly employed to redraw a shell after using an Ⓔ or Ⓧ GINK to erase a portion of the shell, but may also be used to redraw the shell when the display becomes overly cluttered with prompting messages, displays of properties, etc.

Using the Ⓡ GINK will not effect the contents of the EDIT file.

5.16 S GINK

Purpose: To suppress the entry of information into the EDIT file in response to A , M , L , and W GINKS.

Discussion: Normally, entering an A , L , M , or W GINK will result not only in the displaying of the desired linework or text, but also in the generation of cards in the EDIT file corresponding to this linework or text. Therefore, any time the shell is redrawn, the linework created will also be redrawn. Sometimes, however, user wishes to add a text comment or linework just for a temporary display, without wishing the items to become part of the EDIT file data base. Depressing S will suppress the entry of all A , M , L and W item types into the EDIT file, until: (1) a new shell is begun by a <u>NEW</u> directive or N GINK, or (2) a U GINK is issued to remove the effect of the S GINK.

<u>Example</u>

User wishes to add a comment to the display and make a hardcopy, but he does not want the comment to become a permanent part of the EDIT file data base. To enter his comment, he first depresses S to suppress the entry of his text comment into the data base, and then moves the crosshair cursor to the position on the screen where he wants the lower left-hand corner of the text to begin, and depresses W . He may then enter his text, which will only be displayed until the next erasure of the screen, and will not be entered as a data card in the EDIT file.

5.17 T GINK

Purpose: To display the total properties of the shell, excluding outer volume.

Discussion: The cursors may be positioned any where on the screen when the T GINK is activated because the coordinates are disregarded. In response to a T GINK, PHASOR will display the weight, C.G., and moments of inertia of the entire shell currently on the EDIT file. The outer volume of the shell will not be displayed. If the outer volume is needed, the H GINK should be used instead.

Example:

User wishes to obtain a display of the total properties of his 81 MM shell, as shown in figure 5-20. He depresses T, and PHASOR displays the total properties, as shown in the right-middle of the figure. The column labelled "TR.-P/2" is the planar transverse, T', as defined in section 1.2.

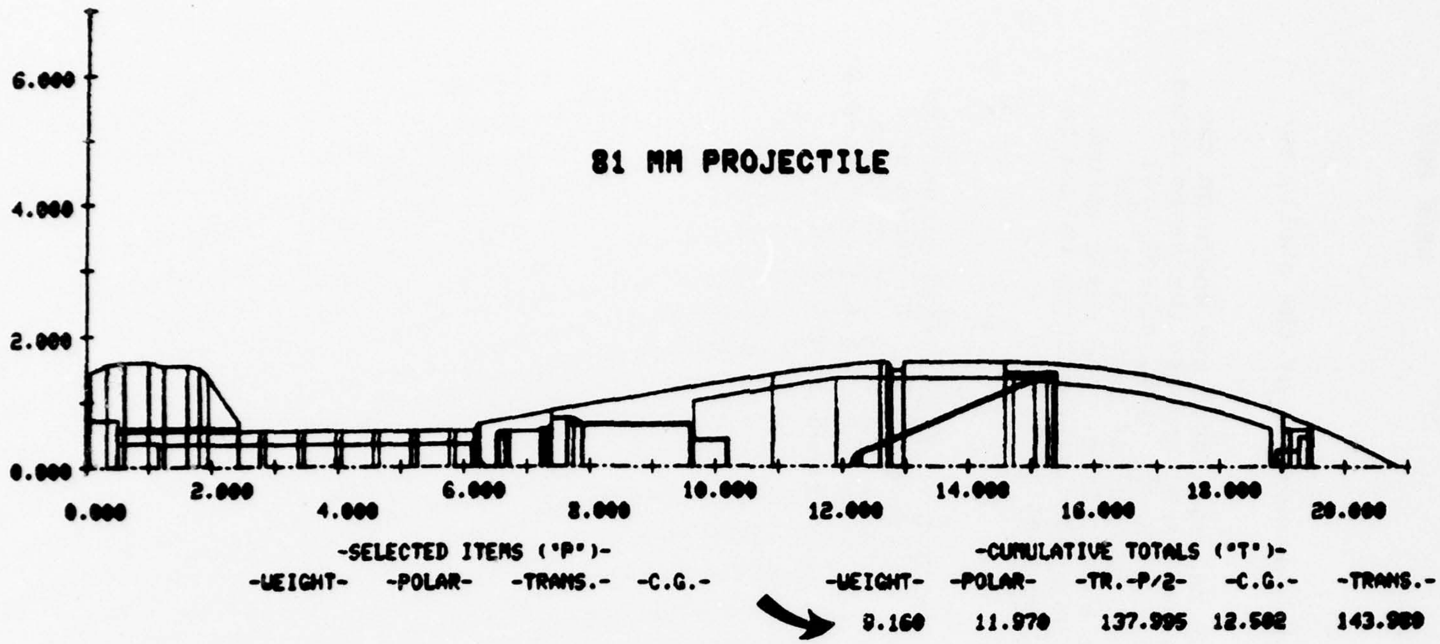


Figure 5-20. Total properties displayed using T keystroke.

5.18 Ⓦ GINK

Purpose: To display a text string and enter the string in the EDIT file for future displays.

Discussion: The Ⓦ GINK is provided to allow user a convenient method of entering comments, titles, and the like on his display. PHASOR will automatically create a Ⓦ data card in the EDIT file corresponding to the information entered, unless an Ⓢ GINK has been previously entered to suppress entry of Ⓐ, Ⓛ, Ⓜ, and Ⓦ GINK information into the EDIT file. The text is always entered in a character size corresponding to TEKTRONIX characters of size 3. If the display is re-drawn to a different scale, the size of the text will be increased or decreased to maintain it in approximately the same proportion as originally entered.

Example

User can create the text display shown in figure 5-21 as follows:

Move the crosshair cursor to (4,2) and depress Ⓦ. When the alphanumeric cursor (blinking rectangle) appears on the screen, enter the desired text string of up to 39 characters, followed by a carriage return.

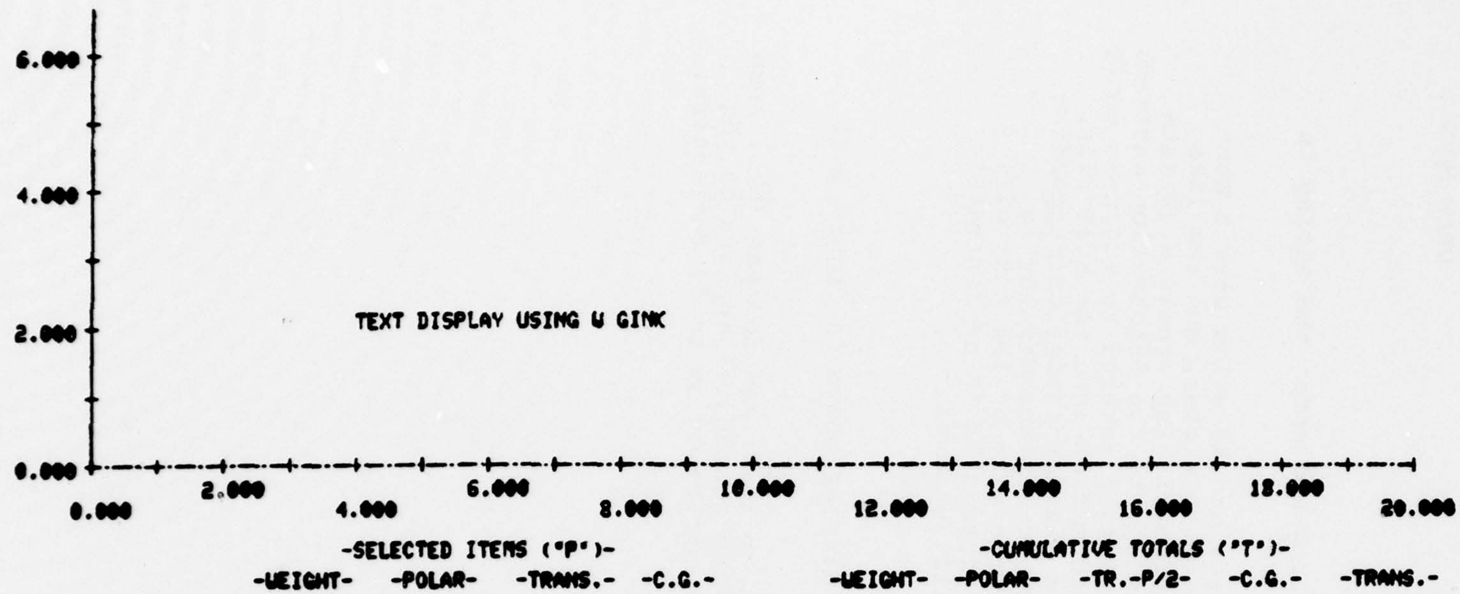


Figure 5-21. Writing a text display using W keystroke.

5.19 X GINK

The X GINK is precisely equivalent to the E GINK as discussed in section 5.5, and is included for compatibility with earlier versions of PHASOR.

5.20 Ⓩ GINK

Purpose: To "zoom" in or out on the display.

Discussion: The Ⓩ GINK allows the user to redraw the shell with different endpoints on the X and/or Y Axes. When a Ⓩ GINK is entered, PHASOR prompts user,

"XMIN,XMAX="

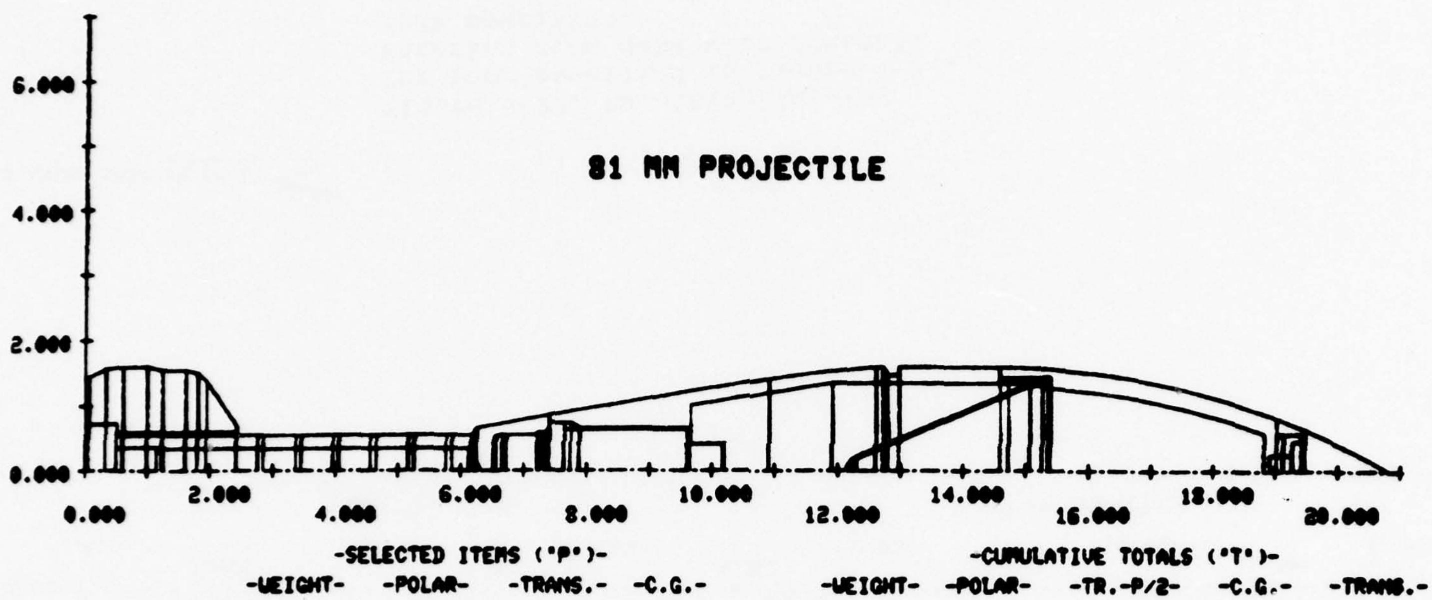
In response, user must enter the values for the ends of the X axis which he desires, separated by a comma. In addition, he may enter the desired value of the minimum Y axis, separated by a comma from XMIN and XMAX. If YMIN (the optional third parameter) is not specified, it is kept the same as its present value, normally 0. If YMIN is specified and is greater than 0, then that value will be used for the minimum Y. If YMIN is specified and is less than 0, this is interpreted as a flag indicating that both the upper and lower half of the shell are to be drawn, i.e., YMIN=-YMAX. YMAX may never be specified. All of these cases are covered in the example below:

Example

Assume user is viewing his display as shown in figure 5-22, and he wishes to "zoom in" on the portion of the shell from X=2 to X=12. To do so, he depresses Ⓩ (the position of the cursor is unimportant), and in response to the prompting message at the bottom of the figure, enters his desired X axis endpoints.

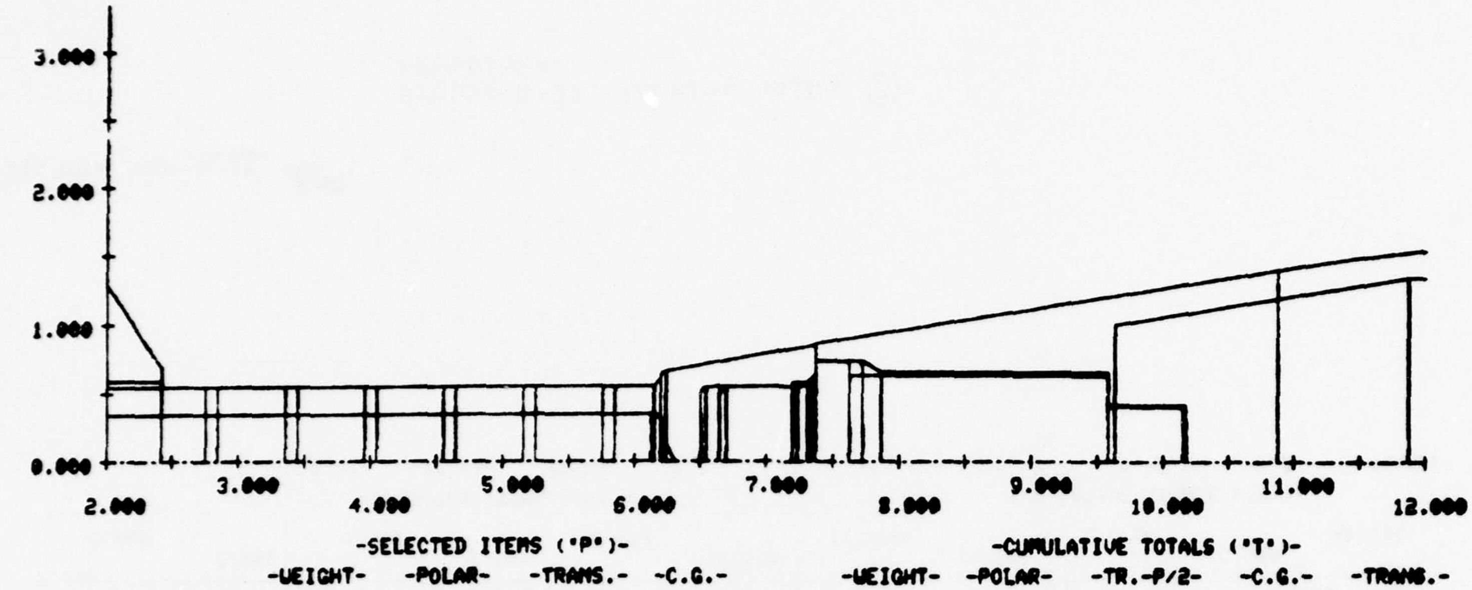
The resulting display is shown in figure 5-23. User then decides to take a very close look at the area of the rotating band of his shell, located at about (13.8,1.8). To do this, he again enters Ⓩ, but this time enters three values, the last being YMIN=1, as shown at the bottom of figure 5-23. If user had not entered YMIN as the third parameter, the understood value of YMIN=0 would have been used, and the portion of the shell of interest would have been above the top of the display area and not shown due to the extreme magnification specified. The resultant display is shown in figure 5-24.

Finally, user wishes to show both halves of the shell (upper and lower), from X=0 to X=18, so he again depresses Ⓩ and enters the desired X axis limits and the third parameter of YMIN=-1, as shown at the bottom of figure 5-24. The resulting display is shown in figure 5-25. Note that YMIN is about -3.0, not -1, because -1 is considered a flag and not a value.



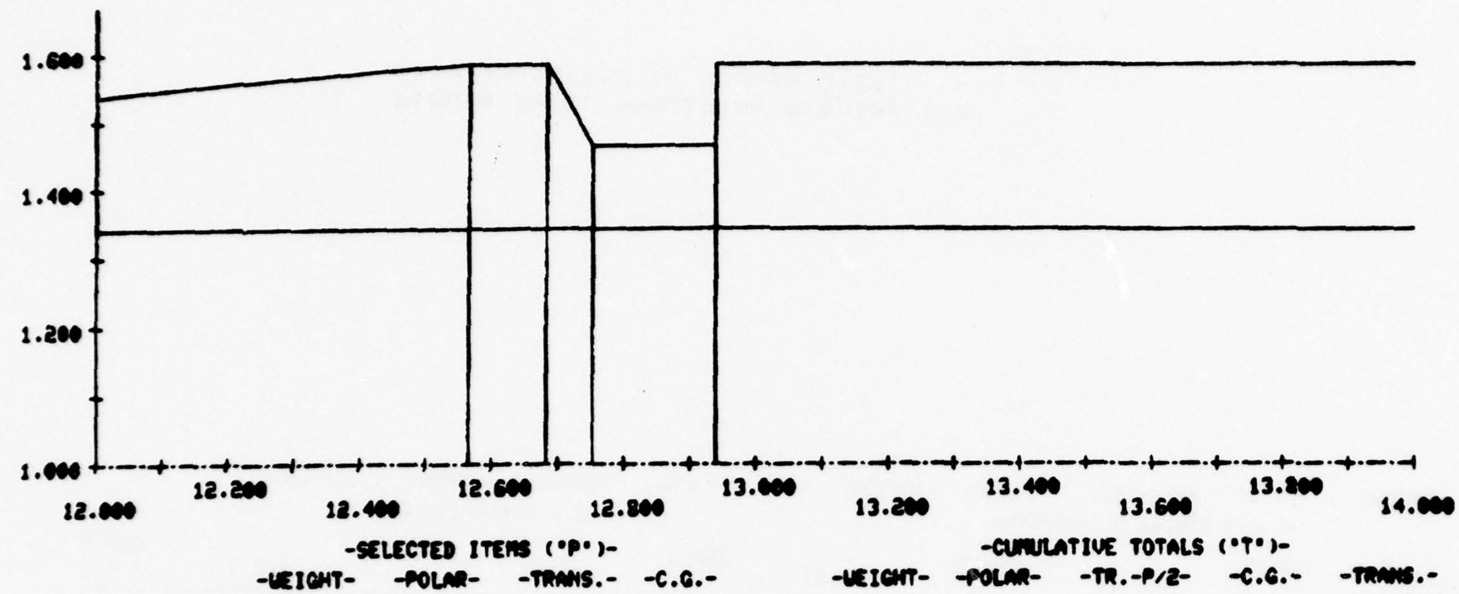
AXIS XMIN, XMAX=2, 12

Figure 5-22. Zooming using Z keystroke.



AXIS XMIN, XMAX=12,14,1

Figure 5-23. Resulting display for zoom specified in figure 5-22. Entering zoom data with optional YMIN specified.



AXIS XMIN, XMAX=0,18,-1

Figure 5-24. Resulting display for zoom specified in figure 5-23. Entering zoom data with negative YMIN specified.

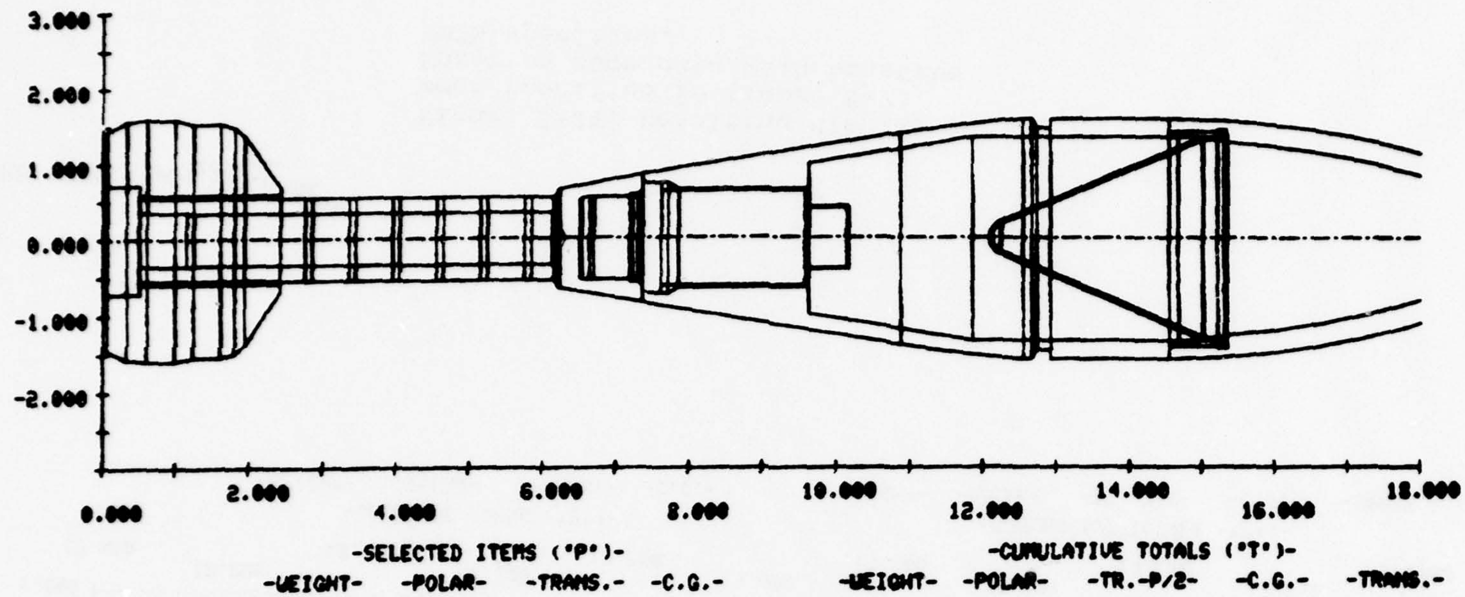


Figure 5-25. Resulting display for zoom specified in figure 5-24.

5.21 ⊘ GINK

Purpose: To return to DIRECTIVE mode and terminate DRAW mode.

Discussion: Depressing ⊘ will cause PHASOR to return to the normal DIRECTIVE mode. The screen will be cleared, and the two slashes indicating DIRECTIVE mode will appear at the top of the screen. The contents of the EDIT file will not be effected.

6. EDIT MODE OPERATION

The EDIT mode of operation gives the user the capability of constructing and modifying data decks interactively during execution of PHASOR. The EDIT mode may be entered at any time from DIRECTIVE mode by typing in the EDIT directive:

//EDIT

The EDIT directive will cause PHASOR to display some or all of the card images currently on the EDIT file. Normally, PHASOR will display the first 20 card images of the deck initially, as shown in figure 6-1. The number of cards displayed is called the page size, and may be altered by an optional parameter on the EDIT directive, as we shall see in section 10. In this section, however, all examples will assume a default page size of 20 cards.

In figure 6-1, the card images proper are contained in the box. The number in parentheses at the top of the page indicates the number of the first card currently being displayed. The numbers in parentheses at the bottom of the page indicate the last card image currently displayed, and the total number of card images on the edit file. In this example, the first card displayed is the first card of the file, the last card on the page is number 20, and there are a total of 92 cards in the EDIT file.

EDIT mode operates in a manner similar to DRAW mode, in that the tasks which the user wishes to have performed are indicated to PHASOR by means of coded keystrokes combined with the position of the graphic crosshairs. Each Graphic Input Keystroke (GINK) has a unique meaning to PHASOR. In the following sections, the specific meaning of each keystroke is outlined and detailed. In general, the procedure for editing card images is to:

(1) Position the file such that the card or cards to be added, deleted, or altered appear on the screen display page. This may be done by paging forward or backward through the EDIT file, or by "scrolling".

(2) "Point at" the card or cards to be altered with the crosshair cursor, and depress the key which corresponds to the task you wish PHASOR to perform.

(3) If additional text is to be added, PHASOR will prompt entry by displaying "=" at the proper location. Enter the desired text in the conventional manner.

```
( 1)
T          81 MM BROM FROM PROMS DECK
W          -2        8         4.5        81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000      .5000     FIN1
1.0925    1.1925    .0500     .1000      6.1450    FIN2
1.3138    1.6842    1.1331    .1000      6.2369    FIN4
.7126     .7126     .6500     -.1000     .5000     -FIN5
.7126     .6850     .1000     -.1000     1.1500    -FIN6
.6850     .6850     4.8750    -.1000     1.2500    -FIN7
.3464     0.0000    .1000     -.1000     6.2100    -FIN9
1.0715    1.0920    .0950     -.1000     6.5450    -FIN11
1.0920    1.0920    .5550     -.1000     6.6400    -FIN12
1.1550    1.1550    .1150     -.1000     7.1950    -FIN13
1.1550    1.2750    .0600     -.1000     7.3100    -FIN14
.9751     1.0851    .0550     .1000      6.6450    ADAP1
1.0851    1.0851    .5350     .1000      6.7000    ADAP2
1.0851    1.1206    .1000     .1000      7.2350    ADAP3
1.1206    1.1906    .0350     .1000      7.3350    ADAP4
1.4552    1.4552    .2500     .1000      7.3700    ADAP5
1.7079    2.7936    3.5102    .2930      7.3700    BODY1
( 20 OF  92)
```

Figure 6-1. EDIT mode display.

(4) To see the corrected page displayed, enter an L, P, B, or S gink which will cause the screen to erase and redraw the updated card images.

As was the case with DRAW mode, user can always tell when PHASOR is done displaying card images because the crosshair cursors will appear, indicating readiness to accept a GINK.

For EDIT mode, the following GINKS are defined:

B	Backward page
C	Copy card(s)
D	Delete card(s)
E	Extract and replace a character string from a card
G	Group operation follows (used to begin an editing operation on more than 1 card)
I	Insert card(s)
L	List the contents of the current page
M	Move card(s) to another location
P	Page forward
R	Replace card(s)
S	Scroll forward or backward
T	To (indicates destination for copy or move)
Ø	Return to DIRECTIVE mode

6.1 (B) GINK

Purpose: To page backwards one page of EDIT file display.

Discussion: This GINK is used to display the cards on the display page preceeding the currently displayed page. Backward paging will display a page starting with card image 1 if the current page begins with any card which would be displayed in a display starting with card number 1.

Example:

Assume user is currently viewing a page starting with card image number 62, shown in figure 6-2. To examine the 20 cards immediately before 62, user depresses (B). The resulting display begins with card image 42 and ends with card image 61, as shown in figure 6-3.

(82)

1.54	1.54	.37	.1	1.8425	.1	FIN BL6
1.54	1.4950	.19	.1	1.6185	.1	FIN BL7
1.495	1.375	.1350	.1	1.8085	.1	FIN BL8
1.375	.6875	.48	.1	1.9375	.1	FIN BL9
.7187	.7187	.5	-.1	0.	.1	-FIN BL10
.59	.59	1.9175	-.1	.5	.1	-FIN BL11
.59	.59	1.9175	.1	.5	.19	FIN BL12
.5462	.5462	1.9175	-.1	.5	.19	-FIN BL13
.5462	.5462	.0004	-.100	2.7548	.0004	-FIN HOL1
.3425	.3425	.0004	.10	2.7548	.0004	FIN HOL1
.5462	.5462	.0004	-.100	3.3548	.0004	-FIN HOL2
.3425	.3425	.0004	.1	3.3548	.0004	FIN HOL2
.5462	.5462	.0004	-.1000	3.9548	.0004	-FIN HOL3
.3425	.3425	.0004	.1	3.9548	.0004	FIN HOL 3
.5462	.5462	.0004	-.1	4.5548	.0004	-FIN HOL4
.3425	.3425	.0004	.1	4.5548	.0004	FIN HOL 4
.5462	.5462	.0004	-.1	5.1548	.0004	-FIN HOL 5
.3425	.3425	.0004	.1	5.1548	.0004	FIN HOL 5
.5462	.5462	.0004	-.1	5.7548	.0004	-FIN HOL 6
.3425	.3425	.0004	.1	5.7548	.0004	FIN HOL 6

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Figure 6-2. EDIT mode display prior to B (backward page) keystroke.

(48)

2.6815	2.6815	3.1506	.0652	11.8740	OCTOL2	
.8850	.8850	.5430	-.0652	9.6340	-OCTOL3	
.4350	2.6815	2.7730	-.0652	12.2516	-OCTOL5	
1.1100	1.1100	.1000	.2830	18.9750	OGIVE2	
1.1428	1.1428	.3200	.2830	19.0850	OGIVE3	
2.8300	2.8300	.0665	-.2830	14.5585	-OGIVE4	
2.8750	2.8750	.1340	-.2830	15.2250	-OGIVE5	
.2500	.2500	.1000	-.2830	18.7750	-OGIVE7	
.5000	.5000	.3500	-.2830	18.8750	-OGIVE8	
.9200	.9200	.1700	-.2830	19.2250	-OGIVE9	
1.1502	1.1502	.4000	-.0700	18.9750	-NOSE2	
1.1875	1.1875	.0500	-.0700	19.3750	-NOSE3	
.4900	.4900	.3500	.0700	18.8750	NOSE4	
.9000	.9000	.1700	.0700	19.2250	NOSE5	
F	6					
1.37	1.435	.0575	.1	0.	.1	FIN BL1
1.435	1.5675	.275	.1	.0575	.1	FIN BL2
1.5675	1.5925	.2750	.1	.3325	.1	FIN BL3
1.5925	1.5925	.3850	.1	.6075	.1	FIN BL4
1.5925	1.54	.25	.1	.9925	.1	FIN BL5

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Figure 6-3. Display after B keystroke.

6.2 © GINK

Purpose: To copy card image(s).

Discussion: This GINK is used to reproduce a copy of one or more card images. To copy one card, the following procedure should be used:

(1) Place the crosshair cursor over the card image to be copied, depress ©.

(2) Position the cursor over the card image which you wish the duplicate image to follow, depress Ⓣ.

The Ⓣ GINK is always required with © to designate the destination for the new card image. The procedure for copying a group of contiguous card images is:

(1) Place the crosshair cursor over the first card image to be copied, depress Ⓖ to indicate a group operation.

(2) Move the cursor over the last card image to be copied, depress ©.

(3) Move the cursor to the card which you wish the duplicated images to follow, depress Ⓣ.

Note: To place the new card image before the first card of the deck, place the crosshair cursor over the "(1)" at the top of the page before depressing Ⓣ. Copy operations may freely traverse page boundaries by inserting Ⓟ, Ⓑ, or Ⓢ GINKS, as required, in the sequence above.

Example:

User wishes to make a duplicate of a card image tagged "ADAP1" (card image 15) as the first body item, as shown in figure 6-4. User places the crosshair cursor over card image 15, depresses ©. PHASOR acknowledges the GINK by drawing a small tic mark to the left of the card image to be copied. User then positions cursor over the "B" card (card image 3), and depresses Ⓣ. PHASOR acknowledges the copy by an arrow indicating the position of the duplicate card image, as shown in figure 6-5. If user now depresses Ⓛ to list the updated page, it would appear as in figure 6-6.

```
( 1)
T          81 MM DROM FROM PROMS DECK
W           -2          8          4.5          81 MM PROJECTILE
D
1.0925     1.0925     5.6450     .1000     .5000     FIN1
1.0925     1.1925     .0500      .1000     6.1450    FIN2
1.3138     1.6842     1.1331     .1000     6.2369    FIN4
.7126      .7126      .0500      -.1000    .5000     -FIN5
.7126      .6850      .1000      -.1000    1.1500    -FIN6
.6850      .6850      4.8750     -.1000    1.2500    -FIN7
.3464      0.0000     .1000      -.1000    6.2100    -FIN9
1.0715     1.0920     .0950      -.1000    6.5450    -FIN11
1.0920     1.0920     .5550      -.1000    6.6400    -FIN12
1.1550     1.1550     .1150      -.1000    7.1950    -FIN13
1.1550     1.2750     .0600      -.1000    7.3100    -FIN14
.9751      1.0851     .0550      .1000     6.6450    ADAP1
1.0851     1.0851     .5350      .1000     6.7000    ADAP2
1.0851     1.1206     .1000      .1000     7.2350    ADAP3
1.1206     1.1906     .0350      .1000     7.3350    ADAP4
1.4552     1.4552     .2500      .1000     7.3700    ADAP5
1.7079     2.7936     3.5102     .2830     7.3700    BODY1
( 20 OF   92)
```

Figure 6-4. Display before Ⓒ (copy card) keystroke.

```
( 1)
T       81 MM BROM FROM PROMS DECK
U          -2         8          4.5         81 MM PROJECTILE
D
1.0925    1.0925    5.6450     .1000      .5000    FIN1
1.0925    1.1925     .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331     .1000     6.2360    FIN4
 .7126     .7126     .0500    -.1000      .5000    -FIN5
 .7126     .6850     .1000    -.1000     1.1500    -FIN6
 .6850     .6850    4.8750    -.1000     1.8500    -FIN7
 .3464    0.0000     .1000    -.1000     6.2100    -FIN8
1.0715    1.0920     .0950    -.1000     6.5450    -FIN11
1.0920    1.0920     .5550    -.1000     6.6400    -FIN12
1.1550    1.1550     .1150    -.1000     7.1950    -FIN13
1.1550    1.2750     .0600    -.1000     7.3100    -FIN14
 .9751    1.0851     .0550     .1000     6.6450    ADAP1
1.0851    1.0851     .5350     .1000     6.7000    ADAP2
1.0851    1.1206     .1000     .1000     7.2350    ADAP3
1.1206    1.1906     .0350     .1000     7.3350    ADAP4
1.4552    1.4552     .2500     .1000     7.3700    ADAP5
1.7079    2.7936    3.5102     .2830     7.3700    BODY1
( 20 OF   92)
```

Figure 6-5. Display after C and T keystrokes.

```
( 1)
T         81 MM BROM FROM PROMS DECK
W           -2       8         4.5       81 MM PROJECTILE
B
.9751     1.0851   .0550     .1000     6.6450   ADAP1
1.0925    1.0925   5.6450    .1000     .5000    FIN1
1.0925    1.1925   .0500     .1000     6.1450   FIN2
1.3138    1.6842   1.1331    .1000     6.2369   FIN4
.7126     .7126    .6500     -.1000    .5000    -FIN5
.7126     .6850    .1000     -.1000    1.1500   -FIN6
.6850     .6850    4.8750    -.1000    1.2500   -FIN7
.3464     0.0000   .1000     -.1000    6.2100   -FIN9
1.0715    1.0920   .0950     -.1000    6.5450   -FIN11
1.0920    1.0920   .5550     -.1000    6.6400   -FIN12
1.1550    1.1550   .1150     -.1000    7.1950   -FIN13
1.1550    1.2750   .0600     -.1000    7.3100   -FIN14
.9751     1.0851   .0550     .1000     6.6450   ADAP1
1.0851    1.0851   .5350     .1000     6.7000   ADAP2
1.0851    1.1206   .1000     .1000     7.2350   ADAP3
1.1206    1.1906   .0350     .1000     7.3350   ADAP4
1.4552    1.4552   .2500     .1000     7.3700   ADAP5
( 20 OF  93)
```

Figure 6-6. Display after L keystroke, illustrating finsihed copy operation.

6.3 D GINK

Purpose: To delete card image(s).

Discussion: To delete a single card image, position the cursor over any part of the card to be deleted and depress D. PHASOR will acknowledge the deletion by placing an "X" next to the card image. Group (multi-card) deletions may be accomplished by preceeding the D with a G. Group deletions are illustrated in section 6.5.

Example:

For the same card images displayed in figure 6-7, user wishes to delete card image number 16, tagged "ADAP1", and card image number 2, the "W" type item descriptor. To delete the card images, user positions the cursor over card image 16 and depresses D. The resultant display is shown in figure 6-7. He then positions the cursor over the second card image and again depresses D. PHASOR acknowledges the deletion by placing an "X" to the left of each deleted image, as shown in figure 6-8. Finally, user depresses L to observe the updated display, as shown in figure 6-9. Note that the total card image count at the bottom of the display indicates that only 91 of the original 93 card images remain as a result of the deletion.

(1)

T	81 MM BROM	FROM PROMS	DECK		
W.	-2	8	4.5	81 MM PROJECTILE	
B					
.9751	1.0851	.0550	.1000	6.6450	ADAP1
1.0925	1.0925	5.6450	.1000	.5000	FIN1
1.0925	1.1925	.0500	.1000	6.1450	FIN2
1.3138	1.6842	1.1331	.1000	6.2369	FIN4
.7126	.7126	.8500	-.1000	.5000	-FIN5
.7126	.6850	.1000	-.1000	1.1500	-FIN6
.6850	.6850	4.8750	-.1000	1.2500	-FIN7
.3464	0.0000	.1000	-.1000	6.2100	-FIN9
1.0715	1.0920	.0950	-.1000	6.5450	-FIN11
1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
X .9751	1.0851	.0550	.1000	6.6450	ADAP1
1.0851	1.0851	.5350	.1000	6.7000	ADAP2
1.0851	1.1206	.1000	.1000	7.2350	ADAP3
1.1206	1.1906	.0350	.1000	7.3350	ADAP4
1.4552	1.4552	.2500	.1000	7.3700	ADAP5

(20 OF 93)

Figure 6-7. Display after D keystroke entered.

```
( 1)
T        81 MM BROM FROM PROMS DECK
U           -2        8        4.5        81 MM PROJECTILE
B
.9751    1.0851    .0550     .1000     6.6450    ADAP1
1.0925   1.0925    5.6450    .1000     .5000     FIN1
1.0925   1.1925    .0500     .1000     6.1450    FIN2
1.3138   1.6842    1.1331    .1000     6.2369    FIN4
.7126    .7126     .6500     -.1000    .5000     -FIN5
.7126    .6850     .1000     -.1000    1.1500    -FIN6
.6850    .6850     4.8750    -.1000    1.2500    -FIN7
.3464    0.0000    .1000     -.1000    6.2100    -FIN9
1.0715   1.0920    .0950     -.1000    6.5450    -FIN11
1.0920   1.0920    .5550     -.1000    6.6400    -FIN12
1.1550   1.1550    .1150     -.1000    7.1950    -FIN13
1.1550   1.2750    .0600     -.1000    7.3100    -FIN14
.9751    1.0851    .0550     .1000     6.6450    ADAP1
1.0851   1.0851    .5350     .1000     6.7000    ADAP2
1.0851   1.1206    .1000     .1000     7.2350    ADAP3
1.1206   1.1906    .0350     .1000     7.3350    ADAP4
1.4552   1.4552    .2500     .1000     7.3700    ADAP5
( 20 OF  93)
```

Figure 6-8. Display after second D keystroke entered.

```
( 1)
T         81 MM BROM FROM PROMS DECK
B
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6
.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0920    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
1.0851    1.0851    .5350     .1000     6.7000    ADAP2
1.0851    1.1206    .1000     .1000     7.2350    ADAP3
1.1206    1.1906    .0350     .1000     7.3350    ADAP4
1.4552    1.4552    .2500     .1000     7.3700    ADAP5
1.7079    2.7936    3.5102    .2830     7.3700    BODY1
3.1695    3.1695    .1173     .2830     12.5660   BODY3
( 20 OF  91)
```

Figure 6-9. Display after L keystroke, showing completed delete operations.

6.4 Ⓔ GINK

Purpose: To extract and replace one or more characters from a card image.

Discussion: This GINK is used when only a portion of a card is to be replaced, with the rest of the card image maintained in its original form. The procedure required is:

(1) Place the crosshair cursor over the first character of the card image which you wish to replace and depress Ⓔ.

(2) Place the crosshair cursor over the last character to be changed and depress Ⓡ . PHASOR will now underline the portion to be replaced and draw an underline and an "=" to prompt you to enter the new replacement character string.

(3) Type in the replacement character string, followed by a carriage return. This completes the task.

Notes: To extract a single character, leave the cursor on the same character when performing step (2) above. The number of characters inserted is always the same as the number deleted; if fewer characters are typed in, PHASOR will pad the character string with trailing blanks. If more characters are typed in than were deleted, the input string will be truncated. Only one extract operation is permitted on a given card image.

Example:

For the sample data in figure 6-10, user discovers two errors in his data. Card image 18 (the seventh card image of the display page) contains an illegal numerical entry, "7.WQ40", and card image 20 contains superfluous numerical entry (which PHASOR interpreted as a tag or label name, "11.5660 BODY3"). Since user does not want to have to type over the entire card image for each of these errors, he uses an Ⓔ GINK. First, user positions the cursor over the "W" of card image 18 and depresses Ⓔ. Then he moves the cursor to the "4" after the "WQ" and depresses Ⓡ (note that user could have just moved the cursor to "W", but in this case wished to replace the "4" too). The resulting display is shown in figure 6-11, where PHASOR is waiting for the three new characters to be entered. Following a similar procedure, user extracts the extraneous numeric entry on card image 20 and replaces it with blanks, as shown in figure 6-12. After depressing Ⓛ, the final display with all the corrections shown is visible in figure 6-13.

(12)

1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
1.0851	1.0851	.5350	.1000	6.7000	ADAP2
1.0851	1.1206	.1000	.1000	7.2350	ADAP3
1.1206	1.1906	.0350	.1000	7.3350	ADAP4
1.4552	1.4552	.2500	.1000	7.4040	ADAP5
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1696	.1173	.2830	12.5660	12.5660 BODY3
3.1696	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14

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Figure 6-10. Display prior to
E keystroke.

(12)

1.0920	1.0920	.5550	-.1000	6.6400	-FIN12	
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13	
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14	
1.0851	1.0851	.5350	.1000	6.7000	ADAP2	
1.0851	1.1206	.1000	.1000	7.2350	ADAP3	
1.1206	1.1906	.0350	.1000	7.3350	ADAP4	
1.4552	1.4552	.2500	.1000	7.4040	ADAP5	
1.7079	2.7936	3.5102	.2830	7.3700	BODY1	
3.1695	3.1695	.1173	.2830	12.5660	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4	
2.9280	2.9280	.1870	.2830	12.7530	BODY5	
3.1695	3.1695	1.6185	.2830	12.9400	BODY6	
2.7910	2.7910	.1265	.2830	14.5585	BODY7	
2.8299	2.8299	.5400	.2830	14.6850	BODY8	
2.8299	2.7608	.0950	.2830	15.2250	BODY9	
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10	
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11	
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12	
.8250	.8250	.0510	-.2830	9.5830	-BODY13	
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14	

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Figure 6-11. Display after E and R keystrokes. PHASOR is waiting for entry of new string.

(12)

1.0920	1.0920	.5550	-.1000	8.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
1.0851	1.0851	.5350	.1000	6.7000	ADAP2
1.0851	1.1206	.1000	.1000	7.2350	ADAP3
1.1206	1.1906	.0350	.1000	7.3350	ADAP4
1.4552	1.4562	.2500	.1000	7.4040	ADAP5
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	12.5660 BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14

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Figure 6-12. A second extract operation using E and R keystrokes.

(12)

1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
1.0851	1.0851	.5350	.1000	6.7000	ADAP2
1.0851	1.1206	.1000	.1000	7.2350	ADAP3
1.1206	1.1906	.0350	.1000	7.3350	ADAP4
1.4552	1.4552	.2500	.1000	7.3700	ADAP5
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14

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Figure 6-13. Display after L keystroke, illustrating finished extraction operations.

6.5 G GINK

Purpose: To inform PHASOR that a group (multicard) operation is to follow.

Discussion: This GINK does not really indicate that an operation should be performed, but rather that the card indicated by the cursor position is the first referenced card for a multicard operation. The nature of the multicard operation may be Group Delete, Group Insert, Group Move, Group Copy, or Group Replace, and is indicated by the next GINK entered. PHASOR will acknowledge a G GINK by drawing a small tic mark to the left of the referenced card image. When the operation is indicated by the next GINK, PHASOR will drawn a square bracket around the complete multicard group being acted upon.

Notes: A group of cards may cross one or more page boundaries. For instance, the first card of the group may be designated by a G GINK, and the user may page forward before indicating the operation and the last card of the group.

Example:

Several different group operations are illustrated below:

In figure 6-14, user performed a Group Delete of four cards, by placing the crosshairs over card image 15 and depressing G, and then moving the crosshairs to card image 18 and depressing D. The updated display of figure 6-15 was obtained by depressing L.

(12)

	1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
	1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
	1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
X	1.0851	1.0851	.5350	.1000	6.7000	ADAP2
X	1.0851	1.1206	.1000	.1000	7.2350	ADAP3
X	1.1206	1.1906	.0350	.1000	7.3350	ADAP4
X	1.4552	1.4552	.2500	.1000	7.3700	ADAP5
	1.7079	2.7936	3.5102	.2830	7.3700	BODY1
	3.1695	3.1695	.1173	.2830	12.5660	BODY3
	3.1695	2.9280	.0697	.2830	12.6833	BODY4
	2.9280	2.9280	.1870	.2830	12.7530	BODY5
	3.1695	3.1695	1.6185	.2830	12.9400	BODY6
	2.7910	2.7910	.1265	.2830	14.5585	BODY7
	2.8299	2.8299	.5400	.2830	14.6850	BODY8
	2.8299	2.7608	.0950	.2830	15.2250	BODY9
	1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
	1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
	1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
	.8250	.8250	.0510	-.2830	9.5830	-BODY13
	1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14

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Figure 6-14. Display after group delete of four cards by using G and D keystrokes.

(12)

1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
1.2500	1.2500	1.9630	.0830	7.6200	FUZE
.8000	.8000	.5740	.0660	9.5830	BOOSTER
.4350	2.6815	2.7730	.3220	12.2516	LINER2

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Figure 6-15. Display after L keystroke, showing effects of group delete operation.

6.5, continued

For the sample data of figure 6-16, user wishes to insert several card images after card image 14, "-FIN14". To perform a group insert, user moves the cursor to card image 14 and depresses G. Leaving the cursor to card image 14, user then depresses I . PHASOR responds by drawing the prompting arrow and the first = sign under the display. User enters the first card image in free format, and depresses carriage return. PHASOR immediately prompts the next line entry with another "=". This procedure is repeated until user has entered all the lines desired, as shown in figure 6-17. To signal PHASOR that no more lines follow, user enters "=" and a carriage return. By depressing L , user can observe the updated display. Note that in the updated display of figure 6-18, PHASOR has formatted the card images into columns for easy readability.

(12)

1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0687	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
1.2500	1.2500	1.9630	.0830	7.6200	FUZE
.8000	.8000	.5740	.0660	9.5830	BOOSTER
.4350	2.6815	2.7730	.3220	12.2516	LINER2

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Figure 6-16. Display prior to group insert operation.

```
(12)
1.0920   1.0920   .5550    -.1000   6.6400    -FIN12
1.1550   1.1550   .1150    -.1000   7.1950    -FIN13
1.1550   1.2750   .0600    -.1000   7.3100    -FIN14
1.7079   2.7936   3.5102   .2830    7.3700    BODY1
3.1695   3.1695   .1173    .2830    12.5660   BODY3
3.1695   2.9280   .0697    .2830    12.6833   BODY4
2.9280   2.9280   .1870    .2830    12.7530   BODY5
3.1695   3.1695   1.6185   .2830    12.9400   BODY6
2.7910   2.7910   .1265    .2830    14.5585   BODY7
2.8299   2.8299   .5400    .2830    14.6850   BODY8
2.8299   2.7608   .0950    .2830    15.2250   BODY9
1.4628   1.4628   .3500    -.2830   7.3700    -BODY10
1.4628   1.3000   .1410    -.2830   7.7200    -BODY11
1.3000   1.3000   1.7220   -.2830   7.8610    -BODY12
.8250    .8250    .0510    -.2830   9.5830    -BODY13
1.9900   2.6815   2.2400   -.2830   9.6340    -BODY14
2.6815   2.6815   3.4460   -.2830   11.8740   -BODY15
1.2500   1.2500   1.9630   .0830    7.6200    FUZE
.8000    .8000    .5740    .0660    9.5830    BOOSTER
.4350    2.6815   2.7730   .3220    12.2516   LINER2
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•1.0851, 1.0851,.5350  .10 6.70 ADAP2
•1.0851   1.1206,  .1000  .1   7.235   ADAP3
•  1.1206 1.1906 .035 .1 7.335,ADAP4
•1.4553 1.4553 .2500, .100 7.37 ADAP5
•=
```

Figure 6-17. Display after group insert using G and I keystrokes. "=" ends entry of inserted cards.

(12)

1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
1.0851	1.0851	.5350	.10	6.70	ADAP2
1.0851	1.1206	.1000	.1	7.235	ADAP3
1.1206	1.1906	.035	.1	7.335	ADAP4
1.4553	1.4553	.2500	.100	7.37	ADAP5
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14

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Figure 6-18. Display after L keystroke illustrating results of group insert.

6.5, continued

The next example, illustrated in figures 6-19 through 6-21, shows how the destination of a group move need not be on the same display page as the card images being moved. In this case, user indicated cards 27 through 32 as comprising a group to be moved by using G and M GINKS. User then depressed B to display the first display page, since he wished to move the cards to that page. By positioning the cursor over card image 2, the "B" card, and depressing T, user designated the destination for the group move. After an L GINK, the resultant display is shown in figure 6-21.

(21)

	3.1695	2.9280	.0697	.2830	12.6833	BODY4
	2.9280	2.9280	.1870	.2830	12.7530	BODY5
	3.1695	3.1695	1.6185	.2830	12.9400	BODY6
	2.7910	2.7910	.1265	.2830	14.5585	BODY7
	2.8299	2.8299	.5400	.2830	14.6850	BODY8
	2.8299	2.7608	.0950	.2830	15.2250	BODY9
X	1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
X	1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
X	1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
X	.8250	.8250	.0510	-.2830	9.5830	-BODY13
X	1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
X	2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
	1.2500	1.2500	1.9630	.0830	7.6200	FUZE
	.8000	.8000	.5740	.0660	9.5830	BOOSTER
	.4350	2.6815	2.7730	.3220	12.2516	LINER2
	2.6815	2.6815	.2954	.3220	15.0246	LINER3
	2.7600	2.7600	.0390	.3220	15.3200	LINER4
	.3627	2.6035	2.7663	-.3220	12.2662	-LINER6
	2.6035	2.6035	.3265	-.3220	15.0325	-LINER7
	1.9900	2.6815	2.2400	.0652	9.6340	OCTOL1

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Figure 6-19. Display after G and M keystrokes to designate source for group move operation.

```
( 1)
T        81 MM BROM FROM PROMS DECK
B
.9751    1.0851   .0550    .1000    6.6450   ADAP1
1.0925   1.0925   5.6450   .1000    .5000    FIN1
1.0925   1.1925   .0500    .1000    6.1450   FIN2
1.3138   1.6842   1.1331   .1000    6.2369   FIN4
.7126    .7126    .6500    -.1000   .5000    -FIN5
.7126    .6850    .1000    -.1000   1.1500   -FIN6
.6850    .6850    4.8750   -.1000   1.2500   -FIN7
.3464    0.0000   .1000    -.1000   6.2100   -FIN8
1.0715   1.0920   .0950    -.1000   6.5450   -FIN11
1.0920   1.0920   .5550    -.1000   6.6400   -FIN12
1.1550   1.1550   .1150    -.1000   7.1950   -FIN13
1.1550   1.2750   .0600    -.1000   7.3100   -FIN14
1.0851   1.0851   .5350    .10      6.70     ADAP2
1.0851   1.1206   .1000    .1       7.235    ADAP3
1.1206   1.1906   .035     .1       7.335    ADAP4
1.4553   1.4553   .2500    .100     7.37     ADAP5
1.7079   2.7936   3.5102   .2830    7.3700   BODY1
3.1695   3.1695   .1173    .2830    12.5660  BODY3
( 20 OF  91)
```

Figure 6-20. Display after B keystroke to page backward, and T keystroke to designate destination for move.

```
( 1)
T         81 MM BROM FROM PROMS DECK
B
1.4628    1.4628    .3500     -.2830    7.3700    -BODY10
1.4628    1.3000    .1410     -.2830    7.7200    -BODY11
1.3000    1.3000    1.7220    -.2830    7.8610    -BODY12
.8250     .8250     .0510     -.2830    9.5830    -BODY13
1.9900    2.6815    2.2400    -.2830    9.6340    -BODY14
2.6815    2.6815    3.4460    -.2830    11.8740   -BODY15
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6
.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0920    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
( 20 OF  91)
```

Figure 6-21. Display after keystroke, showing results of group move operation across page boundary. (L)

6.5, continued

The final example of group operations is a group replace. The number of cards inserted in a group replace need not be the same as the number deleted, as is illustrated in figures 6-24, where user replaced two cards with three using a group replace. User wished to replace cards 15 and 16 of figure 6-22, so he first moved the cursor to card image 15 and depressed G. Then he moved the cursor to the next card image and depressed R. PHASOR responded by displaying "X" beside the deleted card images and an arrow indicating the insertion of the new card images typed in by user in a manner similar to the group insert operation. This is illustrated in figure 6-23, where "=" is used to signify the end of card image entries.

```
( 1)
T          81 MM BROM FROM PROMS DECK
U          -2         8         4.5       81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6
.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0920    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0851    1.0851    .5350     .1000     6.7000    ADAP2
1.0851    1.1206    .1000     .1000     7.2350    ADAP3
1.1206    1.1906    .0350     .1000     7.3350    ADAP4
1.4552    1.4552    .2500     .1000     7.3700    ADAP5
1.7079    2.7936    3.5102    .2830     7.3700    BODY1
( 20 OF  92)
```

Figure 6-22. Display prior to group replace operation.

```
( 1)
T          81 MM BROM FROM PROMS DECK
W           -2        8        4.5        81 MM PROJECTILE
B
1.0925     1.0925    5.6450    .1000      .5000     FIN1
1.0925     1.1925    .0500     .1000      6.1450    FIN2
1.3138     1.6842    1.1331    .1000      6.2369    FIN4
.7126      .7126     .6500     -.1000     .5000     -FIN5
.7126      .6850     .1000     -.1000     1.1500    -FIN6
.6850      .6850     4.8750    -.1000     1.2500    -FIN7
.3464      0.0000    .1000     -.1000     6.2100    -FIN9
1.0715     1.0920    .0950     -.1000     6.5450    -FIN11
1.0920     1.0920    .5550     -.1000     6.6400    -FIN12
1.1550     1.1550    .1150     -.1000     7.1950    -FIN13
1.1550     1.2750    .0600     -.1000     7.3100    -FIN14
.9751      1.0851    .0550     .1000      6.6450    ADAP1
1.0851     1.0851    .5350     .1000      6.7000    ADAP2
1.0851     1.1206    .1000     .1000      7.2350    ADAP3
1.1206     1.1906    .0350     .1000      7.3350    ADAP4
1.4552     1.4552    .2500     .1000      7.3700    ADAP5
1.7079     2.7936    3.5102    .2830      7.3700    BODY1
( 20 OF  92)

*.9751 1.000 0.250 .1 6.645 MOD ADAP1
*1.000 1.0851 .015 .1 6.895 MOD ADAP2
*1.0851 1.0851 .3250 .1 6.660 MOD ADAP2A
*=
```

Figure 6-23. G and R keystrokes caused PHASOR to prompt user to enter replacement cards until "=" entered.

(1)

T	81 MM BROM FROM PROMS DECK				
U	-2	8	4.5	81 MM PROJECTILE	
B					
1.0925	1.0925	5.6450	.1000	.5000	FIN1
1.0925	1.1925	.0500	.1000	6.1450	FIN2
1.3138	1.6842	1.1331	.1000	6.2369	FIN4
.7126	.7126	.6500	-.1000	.5000	-FIN5
.7126	.6850	.1000	-.1000	1.1500	-FIN6
.6850	.6850	4.8750	-.1000	1.2500	-FIN7
.3464	0.0000	.1000	-.1000	6.2100	-FIN9
1.0715	1.0920	.0950	-.1000	6.5450	-FIN11
1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
.9751	1.000	0.250	.1	6.645	MOD ADAP1
1.000	1.0851	.015	.1	6.895	MOD ADAP2
1.0851	1.0851	.3250	.1	6.660	MOD ADAP2A
1.0851	1.1206	.1000	.1000	7.2350	ADAP3
1.1206	1.1906	.0350	.1000	7.3350	ADAP4
1.4552	1.4552	.2500	.1000	7.3700	ADAP5

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Figure 6-24. Display after (L) keystroke, showing results of group replace operation.

6.6 (I) GINK

Purpose: to insert new card image(s).

Discussion: To insert a new card image, place the crosshair cursor over the card image which you wish the new card to to follow and depress (I). PHASOR will draw an arrow indicating the location of the insert, and prompt user by drawing an "=" below the display. The new card image may then be entered, followed by a carriage return.

Procedures for group (multi-card) inserts are illustrated in figure 6-16 and figure 6-17 of section 6.5.

Example:

A sample insert is shown in figure 6-25. To insert a comment card after card image 14, user moved the crosshair cursor to that card image, tagged "FIN14" and depressed (I). After PHASOR drew the arrow and "=", user completed the insert by entering the new card image and a carriage return.

```
( 1)
T         81 MM BROM FROM PROMS DECK
W          -2        8         4.5        81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6
.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0920    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0851    1.0851    .5350     .1000     6.7000    ADAP2
1.0851    1.1206    .1000     .1000     7.2350    ADAP3
1.1206    1.1906    .0350     .1000     7.3350    ADAP4
1.4552    1.4552    .2500     .1000     7.3700    ADAP5
1.7079    2.7936    3.5102    .2830     7.3700    BODY1
( 20 OF  92)

*C    ADAPTOR 1 THRU 5 NEEDED FOR IMPLEMENTING XM866 OPTIION
```

Figure 6-25. Display after (I) keystroke to initiate insert operation for one card.

```
( 1)
T          81 MM BROM FROM PROMS DECK
U          -2        8         4.5        81 MM PROJECTILE
B
1.0925     1.0925    5.6450    .1000      .5000     FIN1
1.0925     1.1925    .0500     .1000      6.1450    FIN2
1.3138     1.6842    1.1331    .1000      6.2369    FIN4
.7126      .7126     .6500     -.1000     .5000     -FIN5
.7126      .6850     .1000     -.1000     1.1500    -FIN6
.6850      .6850     4.8750    -.1000     1.2500    -FIN7
.3464      0.0000    .1000     -.1000     6.2100    -FIN9
1.0715     1.0920    .0950     -.1000     6.5450    -FIN11
1.0920     1.0920    .5550     -.1000     6.6400    -FIN12
1.1550     1.1550    .1150     -.1000     7.1950    -FIN13
1.1550     1.2750    .0600     -.1000     7.3100    -FIN14
C     ADAPTOR 1 THRU 5 NEEDED FOR IMPLEMENTING XM866 OPTIION
.9751      1.0851    .0550     .1000      6.6450    ADAP1
1.0851     1.0851    .5350     .1000      6.7000    ADAP2
1.0851     1.1206    .1000     .1000      7.2350    ADAP3
1.1206     1.1906    .0350     .1000      7.3350    ADAP4
1.4552     1.4552    .2500     .1000      7.3700    ADAP5
( 20 OF  93)
```

Figure 6-26. Display after Ⓛ keystroke, showing result of insert operation.

6.7 Ⓛ GINK

Purpose: To display the updated current display page.

Discussion: The current display page may be re-displayed with all changes shown completed by depressing Ⓛ . The page drawn will always be drawn with the same card image number being drawn first. If this is impossible (for instance, as the result of a DELETE operation which reduced the total number of card images to less than the number of the first card image on the old page), PHASOR will search backwards for the first available card image.

Note that it is not necessary to re-display the page after every edit operation; up to 19 pending edit operations may be "stacked" before it is necessary to update the display page. It is also legal to return to the DIRECTIVE mode (by depressing ⊘) without updating the display page by depressing Ⓛ. The EDIT file will still contain the corrected file, even though it was never displayed as such.

See any other EDIT MODE example for an example of usage of the Ⓛ GINK.

6.8 M GINK

Purpose: To move card image(s).

Discussion: To move a card image to a new position in the EDIT file, place the crosshair cursor over the card image to be moved and depress M. Then move the crosshair cursor to the card image which you wish the relocated card to follow and depress T. PHASOR will acknowledge the completed move by displaying an "X" by the old position, and drawing an arrow from the old position to the new position.

Procedures for a group (multicard) move are illustrated in figures 6-19 through 6-21 of section 6.5.

Example:

User wishes to relocate the comment card, card image 15, of figure 6-27 to the beginning of the deck, before the body data key. To do so, he places the cursor over the comment card, depresses M, and moves the cursor to card image 2. By depressing T, indicating the destination for the move user completes the move, and PHASOR acknowledges it by drawing the arrow shown in figure 6-28. After depressing L, the page was re-listed, as shown in figure 6-29.

```
( 1)
T         81 MM BROM FROM PROMS DECK
U          -2         8          4.5         81 MM PROJECTILE
B
1.0925    1.0925     5.6450     .1000       .5000      FIN1
1.0925    1.1925     .0500      .1000       6.1450     FIN2
1.3138    1.6842     1.1331     .1000       6.2369     FIN4
.7126     .7126      .6500      -.1000      .5000      -FIN5
.7126     .6850      .1000      -.1000      1.1500     -FIN6
.6850     .6850      4.8750     -.1000      1.2500     -FIN7
.3464     0.0000     .1000      -.1000      6.2100     -FIN9
1.0715    1.0920     .0950      -.1000      6.5450     -FIN11
1.0920    1.0920     .5550      -.1000      6.6400     -FIN12
1.1550    1.1550     .1150      -.1000      7.1950     -FIN13
1.1550    1.2750     .0600      -.1000      7.3100     -FIN14
C    ADAPTOR 1 THRU 5 NEEDED FOR IMPLEMENTING XMDSG OPTION
.9751     1.0851     .0550      .1000       6.6450     ADAP1
1.0851    1.0851     .5350      .1000       6.7000     ADAP2
1.0851    1.1206     .1000      .1000       7.2350     ADAP3
1.1206    1.1906     .0350      .1000       7.3350     ADAP4
1.4552    1.4552     .2500      .1000       7.3700     ADAP5
( 20 OF 93)
```

Figure 6-27. Display prior
to move card operation.

```
( 1)
T         81 MM BROM FROM PROMS DECK
W           -2        8        4.5       81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6
.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0920    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
C     ADAPTOR 1 THRU 5 NEEDED FOR IMPLEMENTING XM866 OPTIION
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0851    1.0851    .5350     .1000     6.7000    ADAP2
1.0851    1.1206    .1000     .1000     7.2350    ADAP3
1.1206    1.1906    .0350     .1000     7.3350    ADAP4
1.4552    1.4552    .2500     .1000     7.3700    ADAP5
( 20 OF  93)
```

Figure 6-28. M and T keystokes used to move a card image.

```
( 1)
T        81 MM BROM FROM PROMS DECK
W          -2          8           4.5         81 MM PROJECTILE
C      ADAPTOR 1 THRU 5 NEEDED FOR IMPLEMENTING XM866 OPTION
B
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6
.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0920    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0851    1.0851    .5350     .1000     6.7000    ADAP2
1.0851    1.1206    .1000     .1000     7.2350    ADAP3
1.1206    1.1906    .0350     .1000     7.3350    ADAP4
1.4552    1.4552    .2500     .1000     7.3700    ADAP5
( 20 OF  93)
```

Figure 6-29. Display after (L) keystroke, showing results of move operation.

6.9 Ⓟ GINK

Purpose: To page forward one display page.

Discussion: Attempting to page forward beyond the last display page will result in the display of "*E-O-F", indicating END-OF-FILE.

Example:

Having examined the data card images on the display page shown in figure 6-30, user wished to advance the display. He depresses Ⓟ, and the display of figure 6-31 is displayed, showing the next 20 card images on the file.

```
( 1)
T          81 MM BRON FROM PROMS DECK
W           -2          8          4.5        81 MM PROJECTILE
C       ADAPTOR 1 THRU 5 NEEDED FOR IMPLEMENTING XM866 OPTIION
B
1.0925     1.0925     5.6450     .1000      .5000      FIN1
1.0925     1.1925     .0500      .1000      6.1450     FIN2
1.3138     1.6842     1.1331     .1000      6.2369     FIN4
.7126      .7126      .6500      -.1000     .5000      -FIN5
.7126      .6850      .1000      -.1000     1.1500     -FIN6
.6850      .6850      4.8750     -.1000     1.2500     -FIN7
.3464      0.0000     .1000      -.1000     6.2100     -FIN9
1.0715     1.0920     .0950      -.1000     6.5450     -FIN11
1.0920     1.0920     .5550      -.1000     6.6400     -FIN12
1.1550     1.1550     .1150      -.1000     7.1950     -FIN13
1.1550     1.2750     .0600      -.1000     7.3100     -FIN14
.9751      1.0851     .0550      .1000      6.6450     ADAP1
1.0851     1.0851     .5350      .1000      6.7000     ADAP2
1.0851     1.1206     .1000      .1000      7.2350     ADAP3
1.1206     1.1906     .0350      .1000      7.3350     ADAP4
1.4552     1.4552     .2500      .1000      7.3700     ADAP5
( 20 OF  93)
```

Figure 6-30. Display prior to page-forward operation.

(21)

1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7600	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
1.2500	1.2500	1.9630	.0830	7.6200	FUZE
.8000	.8000	.5740	.0660	9.5830	BOOSTER
.4350	2.6815	2.7730	.3220	12.2516	LINER2
2.6815	2.6815	.2954	.3220	15.0246	LINER3
2.7600	2.7600	.0390	.3220	15.3200	LINER4
.3627	2.6035	2.7663	-.3220	12.2662	-LINER6

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Figure 6-31. Display after P keystroke.

6.10 Ⓡ GINK

Purpose: To replace card image(s).

Discussion: To replace a single card image, place the crosshair cursor over the desired card image and depress Ⓡ. PHASOR will display an "X" beside the card, indicating its removal, and will draw an arrow and an "=", to prompt entry of the replacement card image. Typing in the desired card image, followed by a carriage return, completes the replacement sequence.

The procedure for group (multicard) replacement is illustrated in figure 6-22 through 6-24 of section 6.5.

Example:

For the data display shown in figure 6-32, user wishes to replace card image number 30, tagged "-BODY11". He therefore places the crosshair cursor over that card image and depresses Ⓡ. Then he types in the new card image, as shown in figure 6-33. To view the updated display, user then depresses Ⓛ, and the display of figure 6-34 appears.

(21)

1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4028	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
1.2500	1.2500	1.9630	.0830	7.6200	FUZE
.8000	.8000	.5740	.0660	9.5830	BOOSTER
.4350	2.6815	2.7730	.3220	12.2516	LINER2
2.6815	2.6815	.2954	.3220	15.0246	LINER3
2.7600	2.7600	.0390	.3220	15.3200	LINER4
.3627	2.6035	2.7663	-.3220	12.2662	-LINER6

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Figure 6-32. Display prior to replace operation.

```
(21)
1.7070     2.7936     3.5102     .2830      7.3700     BODY1
3.1695     3.1695     .1173      .2830      12.5660    BODY3
3.1695     2.9280     .0697      .2830      12.6833    BODY4
2.9280     2.9280     .1870      .2830      12.7530    BODY5
3.1695     3.1695     1.6185     .2830      12.9400    BODY6
2.7910     2.7910     .1265      .2830      14.5585    BODY7
2.8299     2.8299     .5400      .2830      14.6850    BODY8
2.8299     2.7600     .0950      .2830      15.2250    BODY9
1.4628     1.4628     .3500      -.2830     7.3700     -BODY10
1.4628     1.3000     .1410      -.2830     7.7200     -BODY11
1.3000     1.3000     1.7220     -.2830     7.8610     -BODY12
.8250      .8250      .0510      -.2830     9.5830     -BODY13
1.9900     2.6815     2.2400     -.2830     9.6340     -BODY14
2.6815     2.6815     3.4460     -.2830     11.8740    -BODY15
1.2500     1.2500     1.9630     .0830      7.6200     FUZE
.8000      .8000      .5740      .0660      9.5830     BOOSTER
.4350      2.6815     2.7730     .3220      12.2516    LINER2
2.6815     2.6815     .2954      .3220      15.0246    LINER3
2.7600     2.7600     .0390      .3220      15.3200    LINER4
.3627      2.6035     2.7663     -.3220     12.2662    -LINER6
( 40 OF  93)

•1.4628  1.3  .141, -.221,7.7200, -BODY11-FILLER
```

Figure 6-33. (R) keystroke used to replace card image.

(21)

1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3	.141	-.221	7.7200	-BODY11-FILLER
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
1.2500	1.2500	1.9630	.0830	7.6200	FUZE
.8000	.8000	.5740	.0660	9.5830	BOOSTER
.4350	2.6815	2.7730	.3220	12.2516	LINER2
2.6815	2.6815	.2954	.3220	15.0246	LINER3
2.7600	2.7600	.0390	.3220	15.3200	LINER4
.3627	2.6035	2.7663	-.3220	12.2662	-LINER6

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Figure 6-34. Display after L keystroke, showing results of replace operation.

6.11 Ⓢ GINK

Purpose: To scroll forward or backward.

Discussion: Scrolling gives the user the ability to display a page starting with any desired card image. To scroll, depress Ⓢ (the position of the crosshair cursors is immaterial), and when PHASOR displays an "=" under the display, enter the numeric value for the card image number of the card desired to be the first on the display, and depress carriage return. Attempting to display beyond the last card image of the EDIT file will result in the display of "*E-O-F". Attempting to scroll with a card image of less than 1 will result in the display of the first page of the EDIT file.

Example:

User's display is shown in figure 6-35. He wishes to be able to view card images 16 and 25 simultaneously. Since he cannot page backwards (Ⓑ GINK), because this would not display card images after 20, user depresses Ⓢ to scroll and enters "14" for the card image number desired. PHASOR therefore displays a new page beginning with card image 14, which encompasses both card image 16 and 25, as shown in figure 6-36.

(21)

3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
1.2500	1.2500	1.9630	.0830	7.6200	FUZE
.8000	.8000	.5740	.0660	9.5830	BOOSTER
.4350	2.6815	2.7730	.3220	12.2516	LINER2
2.6815	2.6815	.2954	.3220	15.0246	LINER3
2.7600	2.7600	.0390	.3220	15.3200	LINER4
.3627	2.6035	2.7663	-.3220	12.2662	-LINER6
2.6035	2.6035	.3265	-.3220	15.0325	-LINER7

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*14

Figure 6-35. Display after S keystroke. User enters desired starting card number.

(14)

1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
.9751	1.0851	.0550	.1000	6.6450	ADAP1
1.0851	1.0851	.5350	.1000	6.7000	ADAP2
1.0851	1.1206	.1000	.1000	7.2350	ADAP3
1.1206	1.1906	.0350	.1000	7.3350	ADAP4
1.4552	1.4552	.2500	.1000	7.3700	ADAP5
1.7079	2.7936	3.5102	.2830	7.3700	BODY1
3.1695	3.1695	.1173	.2830	12.5660	BODY3
3.1695	2.9280	.0697	.2830	12.6833	BODY4
2.9280	2.9280	.1870	.2830	12.7530	BODY5
3.1695	3.1695	1.6185	.2830	12.9400	BODY6
2.7910	2.7910	.1265	.2830	14.5585	BODY7
2.8299	2.8299	.5400	.2830	14.6850	BODY8
2.8299	2.7608	.0950	.2830	15.2250	BODY9
1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
.8250	.8250	.0510	-.2830	9.5830	-BODY13
1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15

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Figure 6-36. Display after completed scroll operation.

6.12 ∅ GINK

Purpose: To return from EDIT mode to DIRECTIVE mode.

Discussion: Depressing ∅ will cause PHASOR to terminate all editing operations and return to directive mode. The contents of the EDIT file will include all pending editing operations made up to that point.

DIRECTIVE mode operations will be indicated by the erasure of the edit display, followed by the DIRECTIVE mode prompt:

//

6.13 EDIT MODE RESTRICTIONS

The following restrictions should be observed in using EDIT MODE:

(1) Up to 19 edit operations may be performed without erasing the display and updating the results by a L , P , B , or S GINK.

(2) The destination for a GROUP MOVE or GROUP COPY may not be in the group of card images being moved or copied.

(3) No card should have more than one editing operation referencing it at a time. For instance, it is illegal to EXTRACT a character string from a card and move the card without re-listing the page between the operations.

(4) A maximum of 13 lines (card images) of input may be typed in before re-listing the page. For instance, a group insert should be limited to 5 card images if it follows a group replace of 8 card images on the same display. This requirement is due to the limitations of the number of lines which can be displayed on the screen.

7. TABLET MODE OPERATION

The TABLET mode of operation gives the user the ability to input graphical descriptions of items directly to PHASOR for analysis. Normally this graphical description will consist of a full-scale engineering drawing or sketch. To describe the item to be analyzed, the user places the sketch on the tablet and tapes it in place. When the user instructs PHASOR to enter the tablet mode by typing, "TABLET", the program will lead the user through a short initialization procedure to determine the scale of the drawing used. After this procedure is completed, user inputs coordinate data from the tablet in a manner similar to DRAW mode, to describe the body, fin, and ogive items of the shell, as required. Non-coordinate data such as densities is entered from the keyboard in response to prompting messages from PHASOR. As each completed item is entered, PHASOR automatically generates a corresponding card image descriptor in the EDIT file, just as is the case for DRAW mode.

In DRAW mode, the coordinate information was entered by positioning the cursor and depressing a key on the terminal which identified the type of item being described. For TABLET mode, coordinate information is entered by positioning the "pen" and depressing the button on the pen. Since the type of item being constructed can't be indicated by the single button on the pen, it must be indicated by depressing a coded key on the keyboard prior to entering the coordinate data. Thus to describe body items, the user depresses "B", carriage RETURN, and then enters coordinate data from the tablet. PHASOR will assume that the same type of item will be continued until another keyboard key is depressed. It is important to note that when these Graphic INput Keystrokes are entered, they must be followed by a carriage RETURN, and they will not show up on the screen.

One special feature of the tablet is its ability to detect the presence of the pen. Special circuitry in the tablet is capable of telling the computer anytime the pen is removed more than about a quarter of an inch from the tablet surface. This is called leaving presence, and this capability is put to use by PHASOR. When entering points, if you don't leave presence between points, PHASOR will assume you are constructing continued items by the "shortcut" method as described in section 5.3. If the pen does leave presence between data points, PHASOR will assume that the second point is not a continued item, but the start of a new item of the same type and density. This distinction will be clarified during the description of the "B" tablet GINK.

In TABLET mode, the combination of one keyboard key plus RETURN is considered as a GINK. Entering a key at the terminal may also be called a keyboard interrupt, since it is used to interrupt the sequence of points from the tablet.

In TABLET mode, the following keystrokes are legal:

"B"	Begin a body item
"C"	Draw all items entered so far on the screen
"D"	Begin an item of the same type as the last with a different density.
"F"	Begin a fin item
"G"	Begin a PHASOR format ogive
"O"	Begin a WEIGHT format ogive
"/"	Return a directive mode

It is important to remember that the operation of the tablet and the terminal display are mutally exclusive. That is, if the tablet is armed (indicated by the READY light being lit on the tablet controller), then no new information will appear on the screen, and if the tablet is disarmed (READY light off), no data can be entered from the tablet. Thus if in doubt as to what input PHASOR expects next, remember that if the READY light is lit PHASOR is waiting for either tablet data or a keyboard interrupt GINK. If the READY light is off, PHASOR is waiting for a type-in from the keyboard of data.

7.1 TABLET INITIALIZATION

Upon entering TABLET mode, PHASOR normally begins a conversational initilization procedure for the tablet used to calibrate the scaling of the drawing used. The initialization consists of four prompting messages, as shown in figure 7-1. PHASOR asks the user to identify the magnitude of the endpoints of the axis of the drawing in whatever units the user wishes, and to pinpoint the location of these endpoints on the drawing, using the pen. Upon completion of the required inputs, PHASOR will draw the axes on the screen, as shown in figure 7-2. Finally, the prompt "READY" appears on the screen to indicate readiness to accept tablet points or keyboard interrupts. The Tablet READY light should also be lit after this prompt.

```
TABLET INITIALIZATION.  ENTER LOGICAL VALUE OF XMIN=0
MARK (XMIN,0) ON TABLET.
ENTER LOGICAL VALUE OF XMAX= 8
MARK (XMAX,0) ON TABLET.
```

Figure 7-1. TABLET mode scaling dialog establishes user's axes on the tablet.

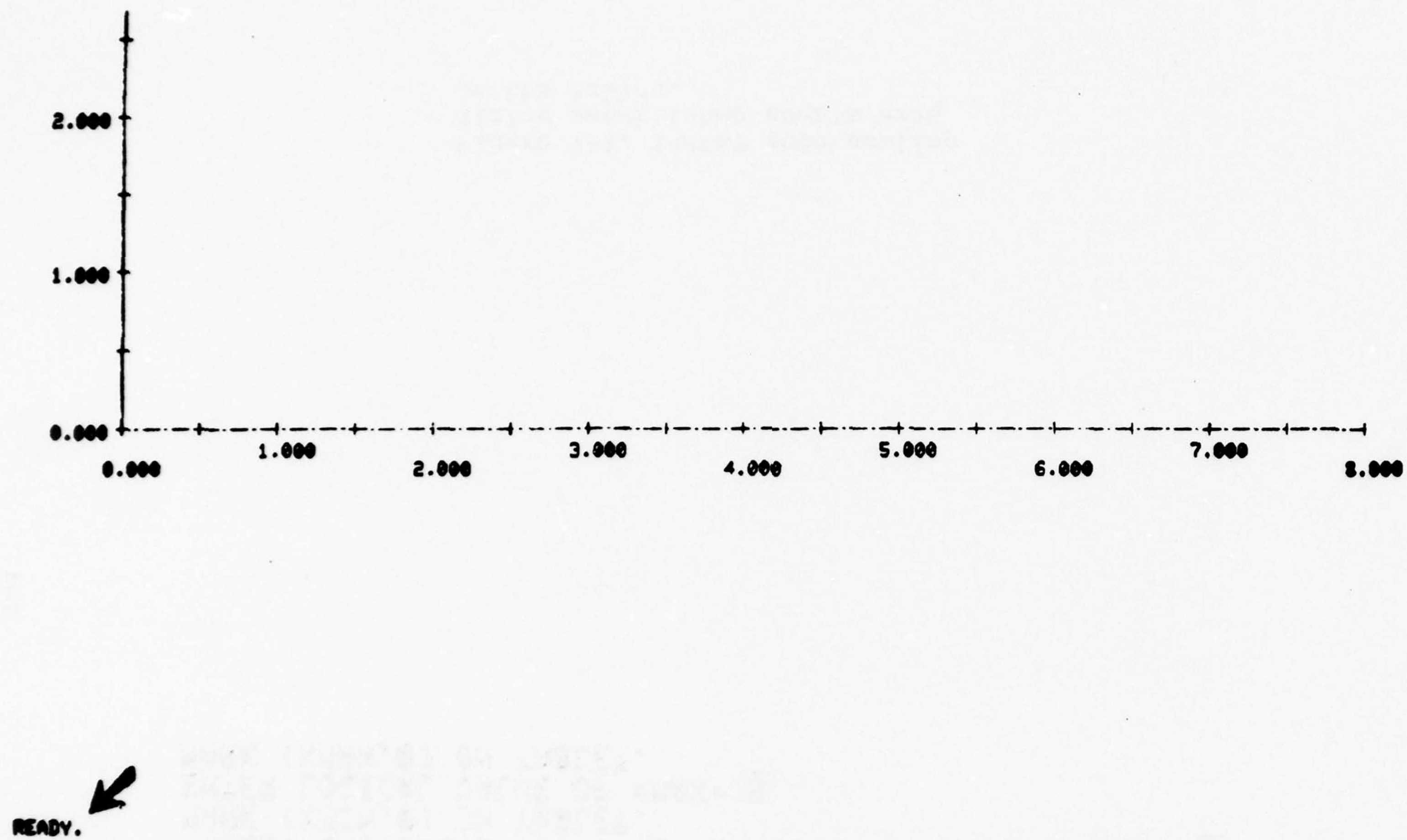


Figure 7-2. After initialization user's axes are displayed on the screen.

7.2 "B" GINK

Purpose: To begin a body item.

Discussion: To enter body items from the tablet, depress the "B" key and RETURN. PHASOR will issue the prompting message, "BEGIN THE BODY ITEM(S)". When the READY light comes on for the tablet controller, you may enter the left-hand endpoint of the first body item. After the point is entered, PHASOR will prompt,

"DENSITY="

which requires a keyboard entry of the density of the item(s), with a carriage RETURN. The READY light will then be re-lit, and you may enter any number of successive points as continued body items. If you wish to make a new body item with the same starting point as the last point entered, slide the pen along the surface of the tablet without leaving presence. If you wish to start a new body item with the same density as the last body item (but not contiguous with its endpoint), lift the pen off the tablet surface by at least an inch before entering the new point. Leaving presence will cause PHASOR to construct a new body itme rather than a continued body item.

Example:

The three body items of figure 7-3 were created by the following sequence after tablet initialization:

1. "B" entered from the keyboard, followed by RETURN.
2, Move pen to (0,1.7), depressed pen button.
3. Entered ".283", RETURN, from keyboard.
4. Moved pen by sliding to (1.5,2,0), depressed button.
5. Moved pen by sliding to (1.8,2.0), depressed button.
6. Moved pen by lifting to (2.0,2.0), depressed button.
7. Moved pen by sliding to (3.0,2.0), depressed button.

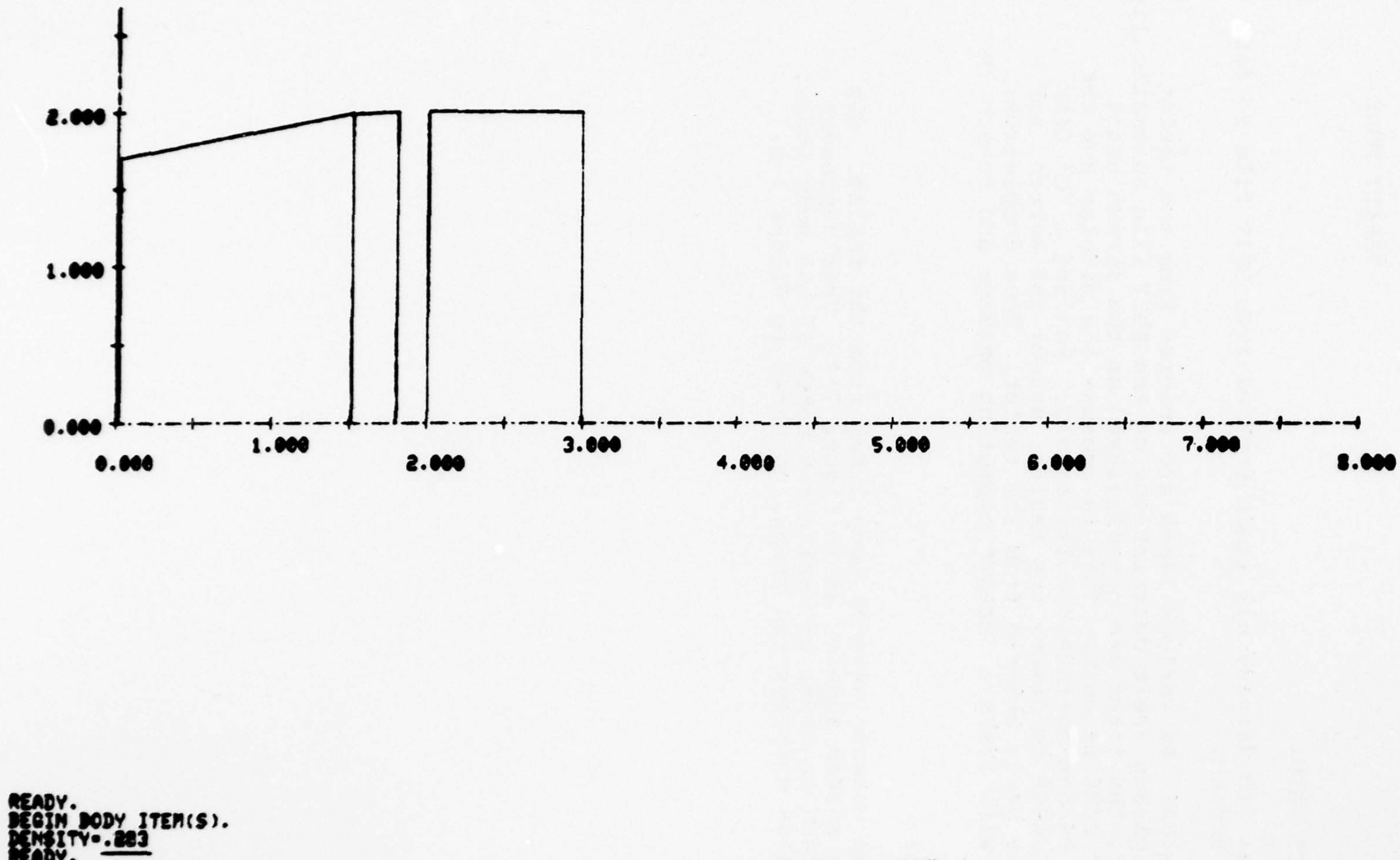


Figure 7-3. Display after "C" and RETURN typed during tablet cession where body items were entered.

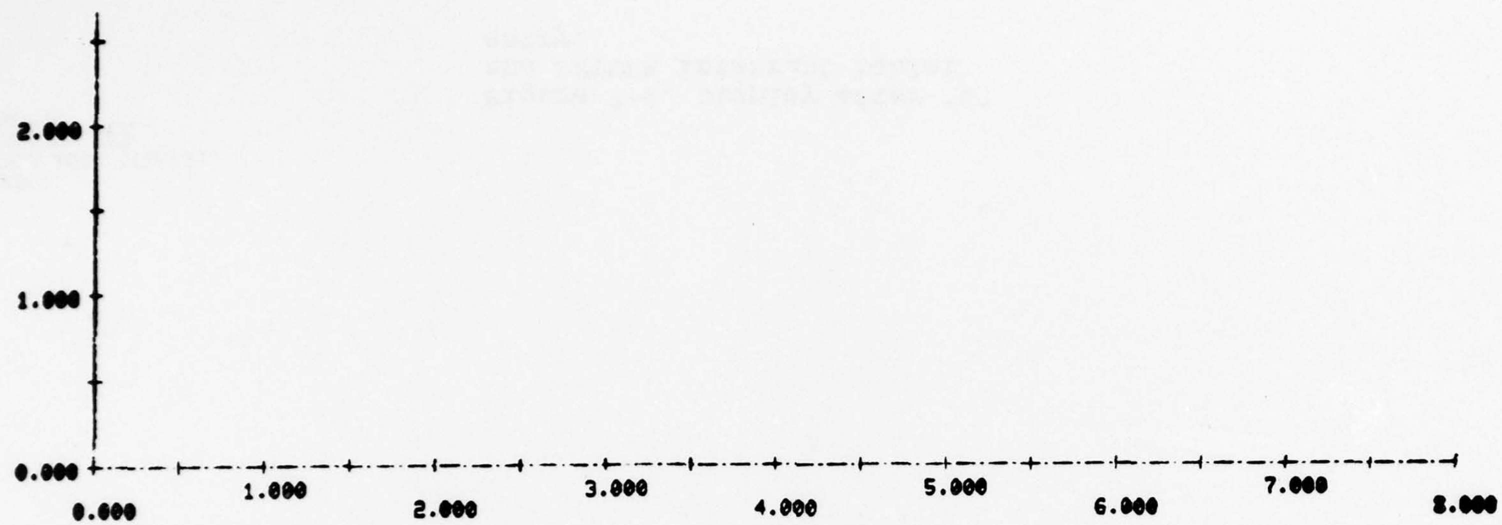
7.3 "C" GINK

Purpose: To display all items entered into EDIT file so far on the screen.

Discussion: As various items are entered from the tablet, PHASOR places their descriptions on the EDIT file automatically. However, the items are not displayed on the screen until the "C" GINK is sent. This is because the display and the tablet cannot operate simultaneously. Sending a "C" GINK tells PHASOR to disarm the tablet, unlock the screen, and draw the parts entered from the tablet. Upon completion, PHASOR will issue a "READY" prompting message and re-arm the tablet.

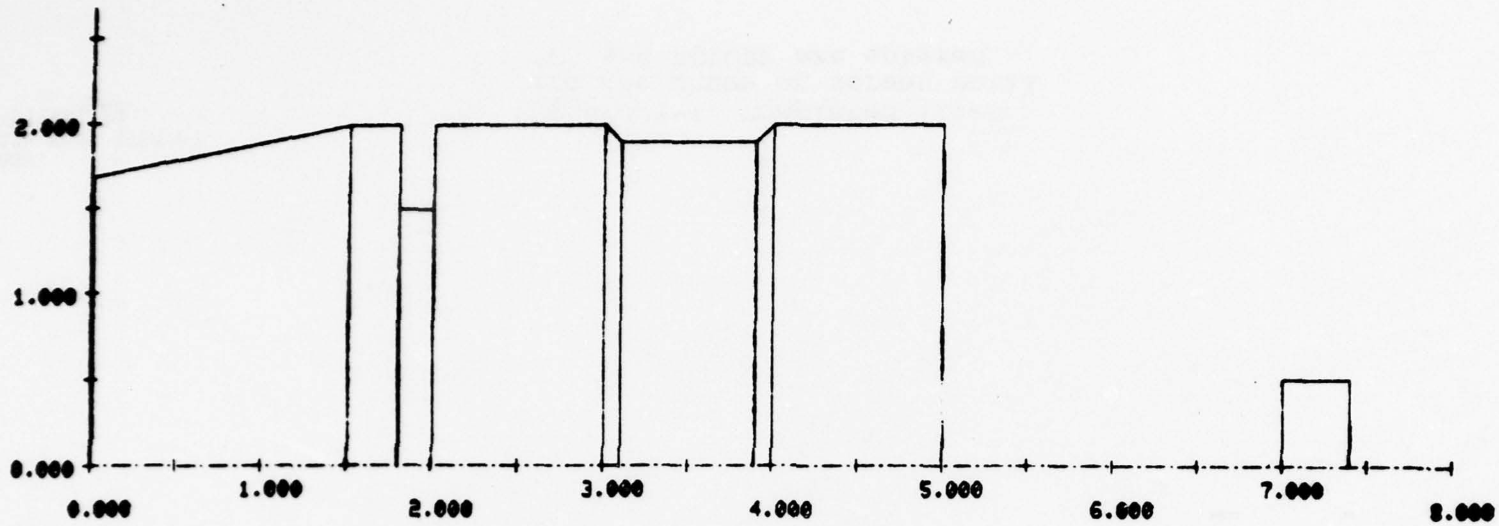
Example:

User has entered several body items from the tablet. His display screen appears as in figure 7-4. User depresses "C" RETURN in order to verify the entry of his body items, and PHASOR displays the items, as shown in figure 7-5.



READY.
BEGIN BODY ITEM(S).
DENSITY=.283

Figure 7-4. Completed items are not shown on screen until "C" and RETURN are entered.




```
READY.
BEGIN BODY ITEM(S).
DENSITY=.283
READY.
```

Figure 7-5. Display after "C" and RETURN interrupt tablet entry.

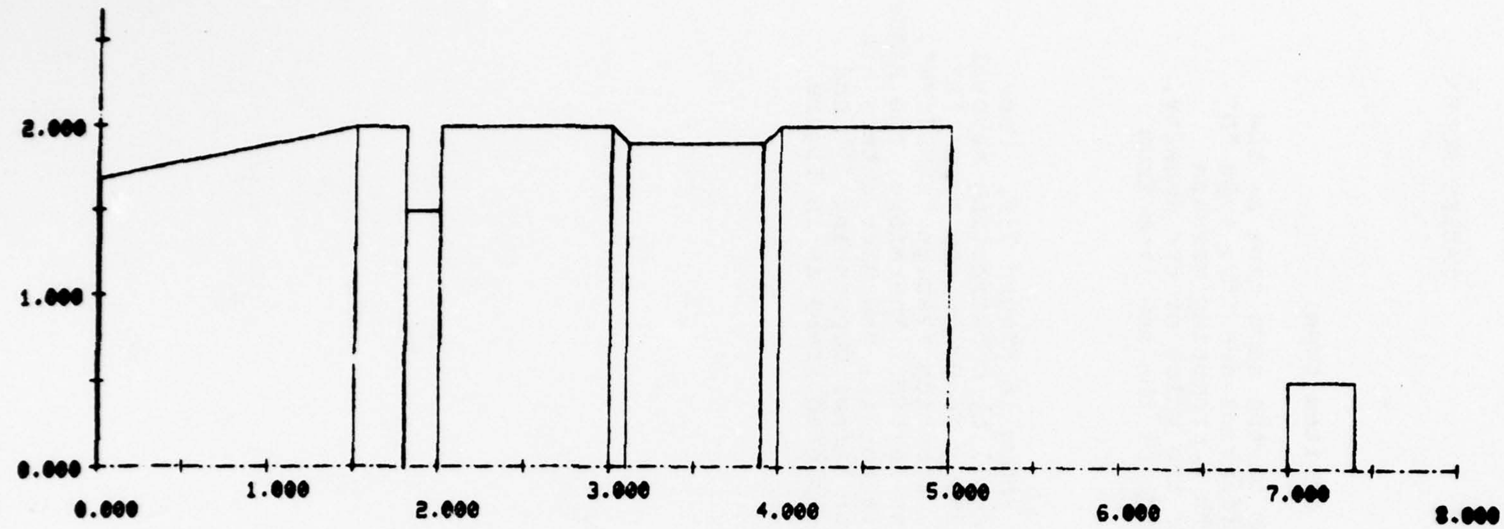
7.4 "D" GINK

Purpose: To change density for an item type.

Discussion: To begin a new item of the same type as the last item entered, but with a different density, type "D", RETURN. PHASOR will respond with a prompting message indicating that you should enter the value of the density. You may then enter the first point of the new item from the tablet.

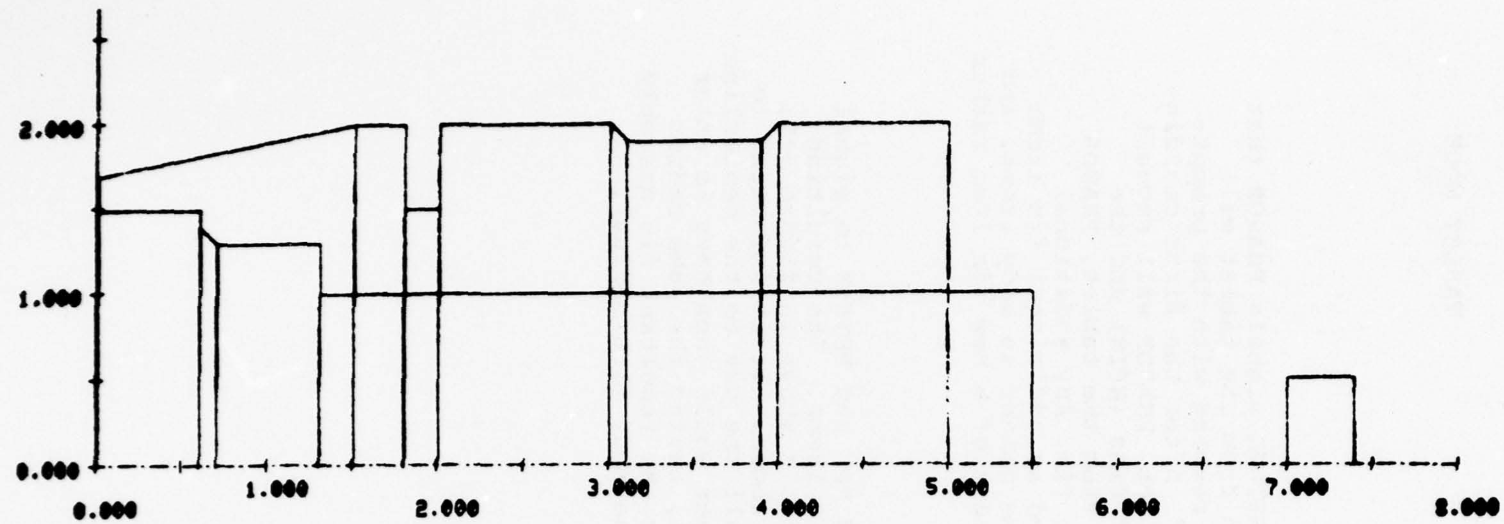
Example:

User has entered the body items shown in figure 7-6. User now wishes to "hollow out" the shell by constructing several body items with a density of -.283. To do so, he types "D" and RETURN. In response to the prompting message "DENSITY=", user enters "-283" and depressess RETURN. Therefore, the READY light on the tablet controller is re-lit, and user enters his body item points from the tablet. After depressing "C" and RETURN, the display shows the completed items as in figure 7-7.




```
READY.
BEGIN BODY ITEM(S).
DENSITY=.283
READY.
DENSITY=-.283
```

Figure 7-6. "D" with RETURN interrupts tablet entry to tell PHASOR to change density.




```
READY.
BEGIN BODY ITEM(S).
DENSITY=.283
READY.
DENSITY=-.283
READY.
```

Figure 7-7. "Hollow" portion of projectile constructed with "D" and RETURN appears after "C" and RETURN.

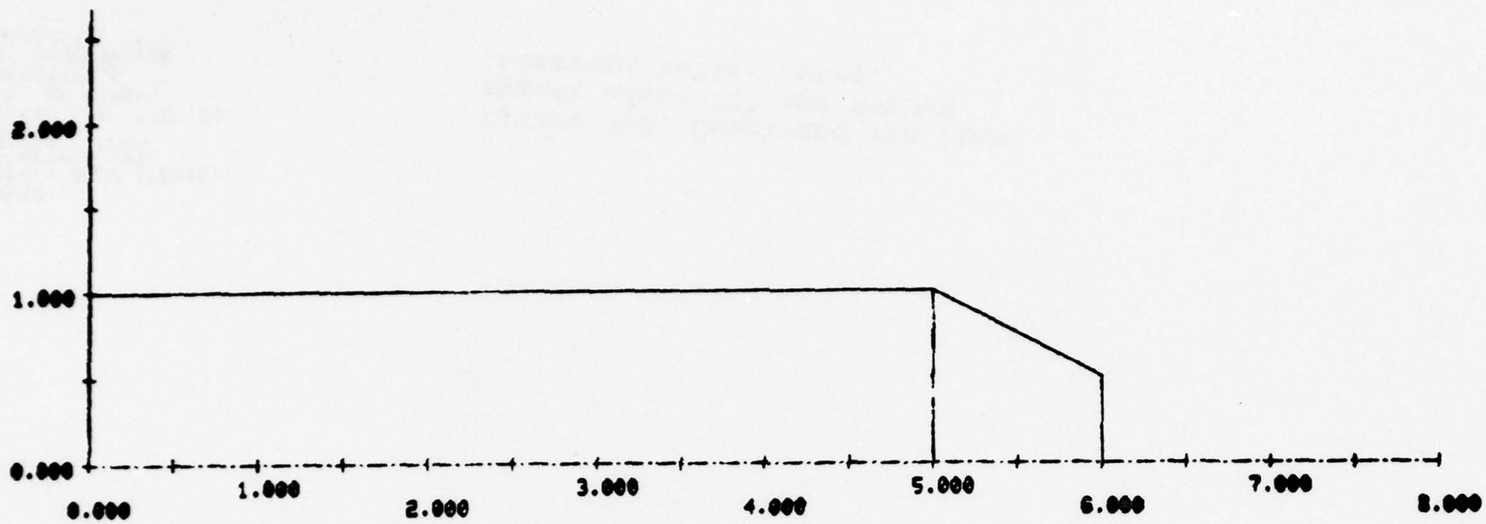
7.5 "F" GINK

Purpose: To begin a fin item.

Discussion: Depressing "F" and RETURN signals PHASOR that the following data points entered from the tablet will comprise fin items. PHASOR will respond with the prompting message, "BEGIN FIN ITEM(S)." After the first coordinate point is entered from the tablet, PHASOR will request that the user enter the number of fins (NFIN) and the density. After the second point from the tablet, PHASOR will ask for the thickness of the fin. Any additional points entered will be interpreted as additional fin items with the same density, in the same manner as body items, and leaving presence indicates the start of a new fin item rather than a continued fin item.

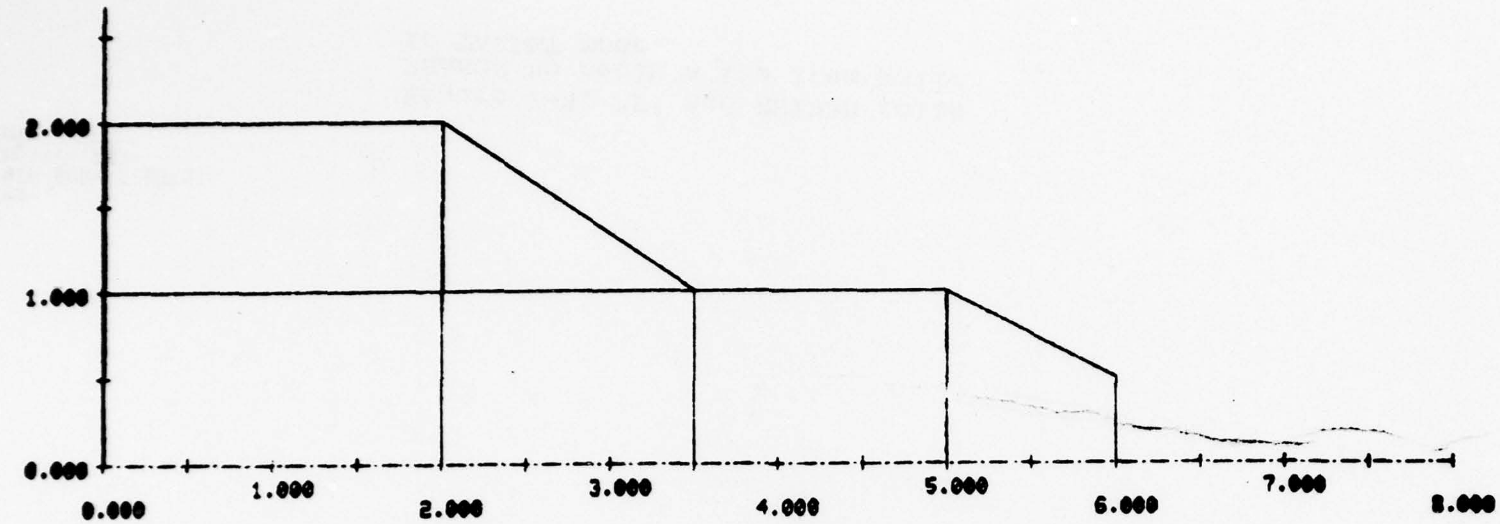
Example:

In figure 7-8, user has depressed "F" and RETURN to signal PHASOR that he wishes to enter fin items. The resulting dialog between PHASOR and the user is shown in figure 7-9, with the two completed fin items shown. It is important to remember that fin items project all the way to the centerline of the shell, so at this point user would then have to enter another fin with a density of -.1, having the same radius as the body of his shell, so that the resultant fin assembly would only extend outward from the body (1.0 radius).



READY.
BEGIN BODY ITEM(S).
DENSITY=.283
READY.

Figure 7-8. "F" and RETURN tells PHASOR to begin a fin item while in TABLET mode.




```
READY.
BEGIN BODY ITEM(S).
DENSITY=.283
READY.
BEGIN FIN  ITEM(S).
NO. OF FINS=4
DENSITY=.1
THICKNESS=.008
READY.
```

Figure 7-9. Completed fin items appear after "C" and RETURN interrupt tablet entry.

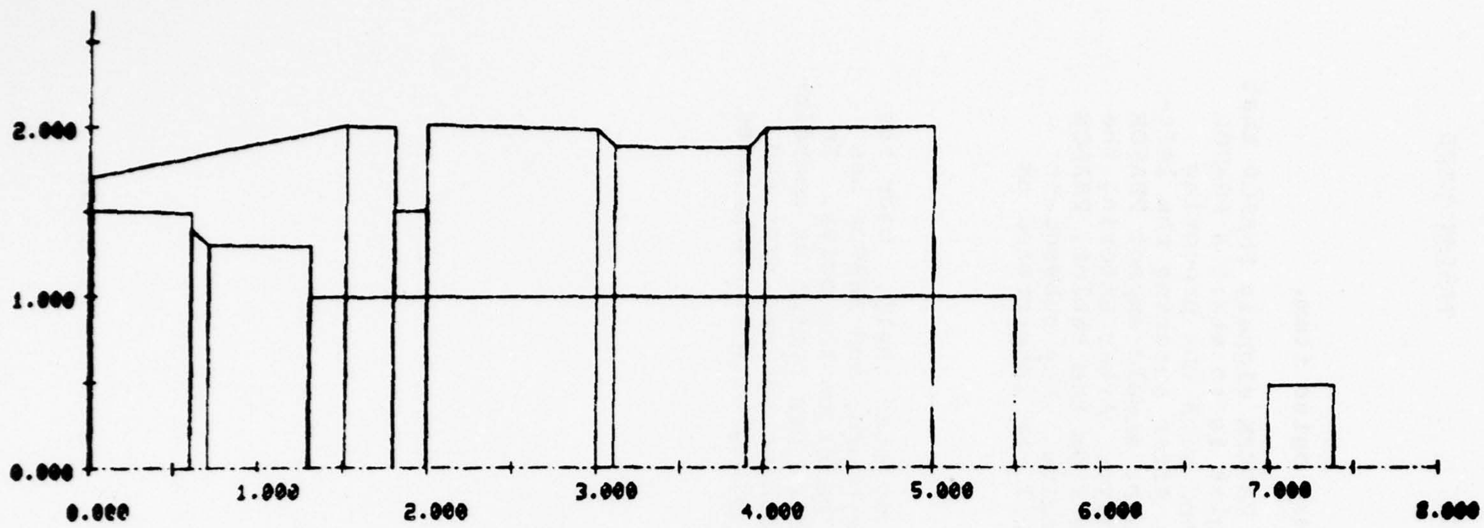
7.6 "G" GINK

Purpose: To begin a PHASOR format ogive item.

Discussion: Depressing "G" and RETURN signals PHASOR that the following point from the tablet is to start a PHASOR format ogive. PHASOR will respond with the prompting message, "BEGIN OGIVE ITEM(S)". After entering the left-hand endpoint from the tablet, user should expect PHASOR to request the density of the ogive. After entering the right-hand endpoint of the ogive from the tablet, PHASOR will request the radius of the ogive. Any subsequent points entered from the tablet will be interpreted as additional ogives.

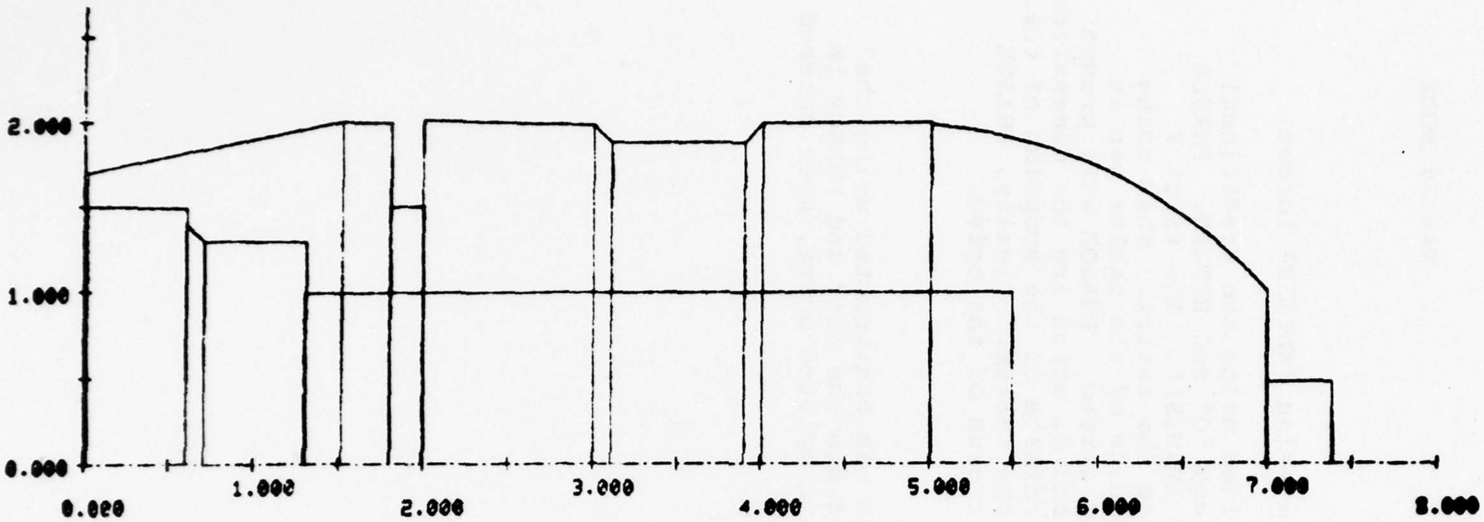
Example:

Figure 7-10 shows a partially completed shell. User has entered "G" and RETURN at the keyboard, and PHASOR has prompted him to enter the first point on the ogive. In this case user depresses the tablet pen button at coordinates (5.0,2.0). The resulting dialog between user and PHASOR is shown in figure 7-11, along with the completed ogive.




```
READY.
BEGIN BODY ITEM(S).
DENSITY=.283
DENSITY=-.283
READY.
BEGIN OGIVEITEM(S).
```

Figure 7-10. "G" and RETURN tells PHASOR to begin a PHASOR format ogive from the tablet.




```
READY.
BEGIN BODY ITEM(S).
DENSITY=.283
DENSITY=-.283
READY.
BEGIN OGIVEITEM(S).
DENSITY=.283
RADIUS =1.[illegible]
READY.
```

Figure 7-11. Completed ogive can be viewed after "C" and RETURN typed in.

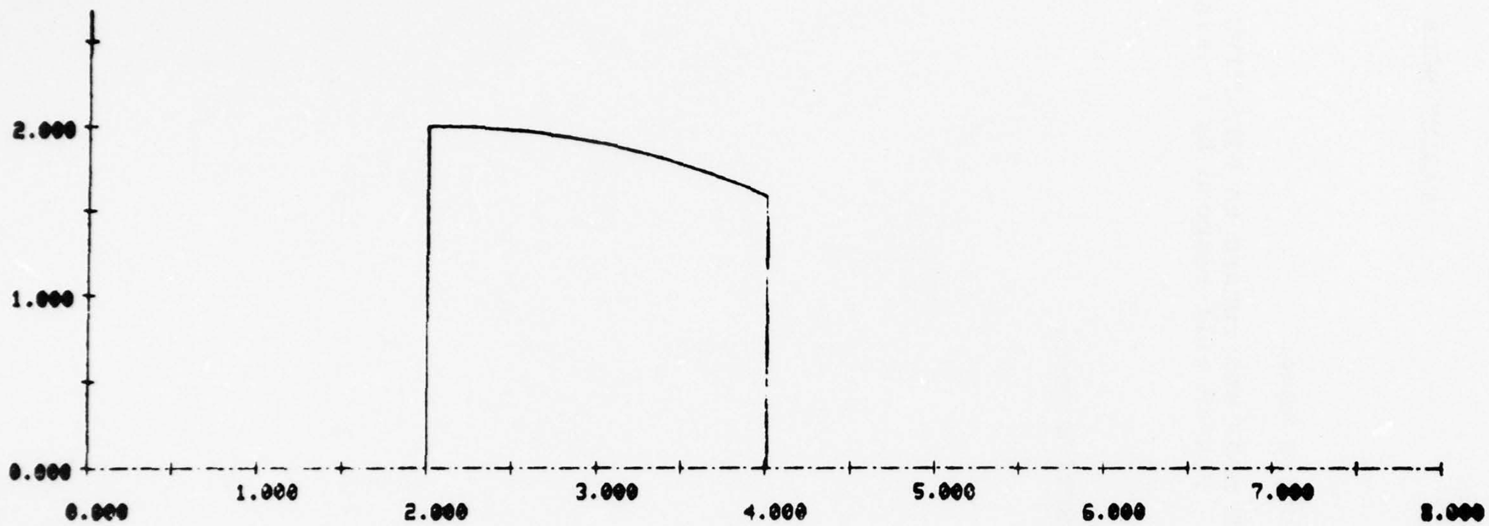
7.7 "O" GINK

Purpose: To begin an ogive item using "WEIGHT" format.

Discussion: To enter an ogive item using the traditional "WEIGHT" program notation, depress "O" and RETURN. PHASOR will respond with, "BEGIN OGIVE ITEM(S)". The first X coordinate may then be entered on the tablet. When using WEIGHT format, only the X coordinate of the tablet pen is used; the Y coordinates are disregarded. PHASOR will prompt user to enter the values for A and B, which are the dimensions shown in figure 3-5. The X coordinate of the endpoint of the ogive may then be entered from the tablet. Finally, PHASOR will request the value for the radius of the ogive.

Example:

Figure 7-12 shows an ogive which was constructed using the "WEIGHT" format. The dialog between the user and PHASOR is shown. In order to display the completed ogive, user entered a "C" GINK.

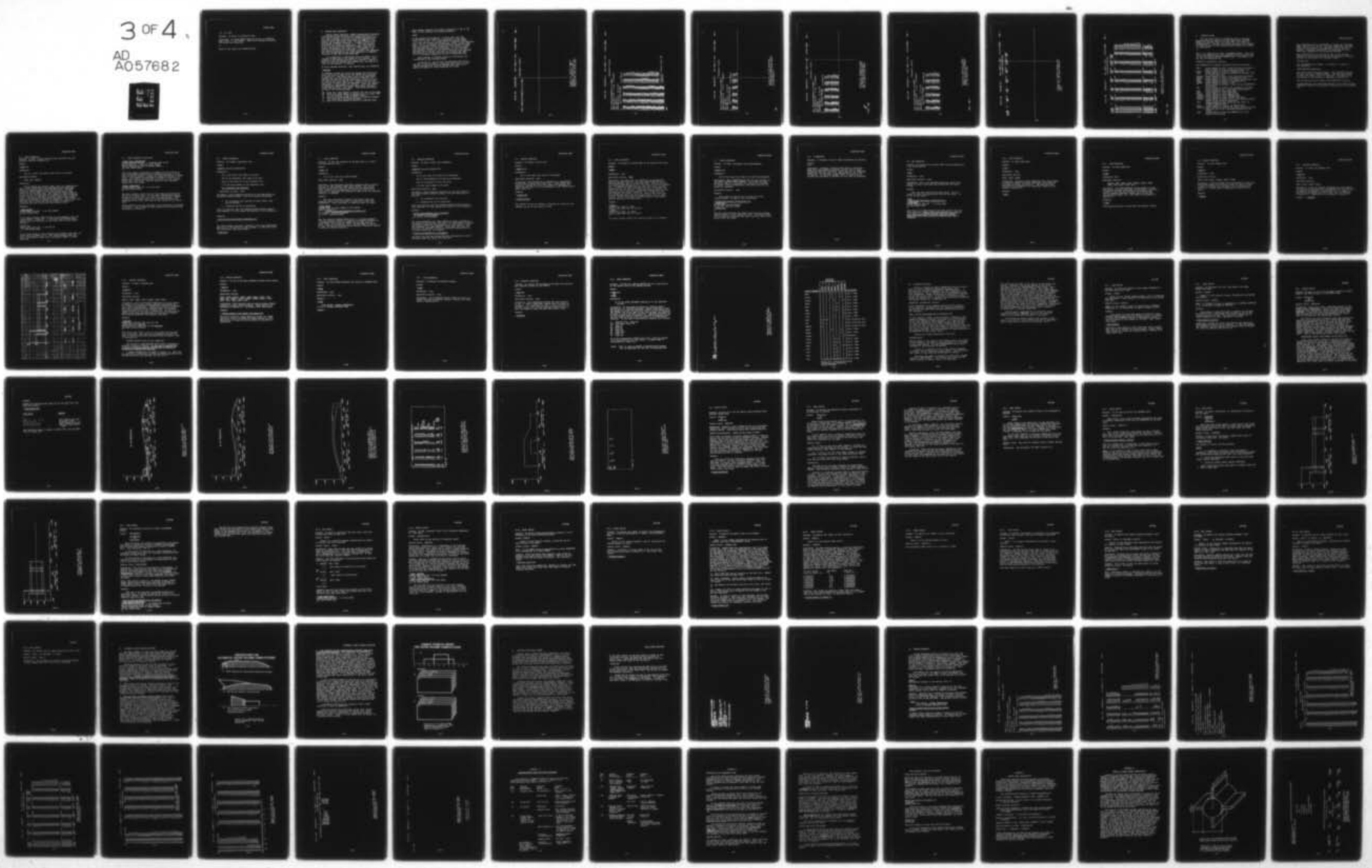


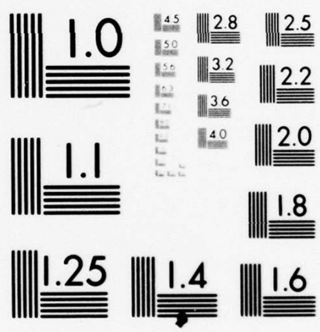

```
READY.
BEGIN OGIVEITEM(S).
A, 2=0,3
DENSITY=.221
RADIUS=6
READY.
```

Figure 7-12. "O" and RETURN trigger entry of "WEIGHT" format ogives.

AD-A057 682 ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND DOVER--ETC F/G 12/1
PHASOR PHYSICAL ANALYSIS OF SOLIDS OF REVOLUTION, USER MANUAL.(U)
APR 78 B D CARBREY
UNCLASSIFIED MISD-UM-78-4 NL

3 OF 4
AD
A057682





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

7.8 "/" GINK

Purpose: To return to directive mode.

Discussion: To cease TABLET mode and return to DIRECTIVE mode, enter "/" and RETURN. PHASOR will respond by erasing the screen and displaying,

//

which is the prompt for DIRECTIVE mode.

8. PREVIEW MODE OPERATION

During normal operation, PHASOR automatically generates a chronology of events which occur during execution on a file called OUTPUT. This file is intended to provide the user with a permanent printed listing of DIRECTIVEs and analysis which take place, which user may SEND to a line printer for permanent retention. A typical OUTPUT file from PHASOR is shown in figure 13-1. The file contains an echo of all directives entered by user, which may be easily identified by the "***** //" prefix added to the listing to emphasize the DIRECTIVES. In addition, the file contains listings of any decks analyzed, and individual and total properties for any items analyzed by a HARDCOPY directive or (H) GINK during DRAW mode.

It is important to understand that the OUTPUT file is normally dormant and is not viewed at the terminal. The purpose of the PREVIEW directive is to provide a method by which the user may examine this OUTPUT file, one page at a time, at the terminal, if desired.

To begin PREVIEW operation, user should enter the DIRECTIVE,

//PREVIEW

In response, PHASOR will erase the screen and display the first few lines of page one of the OUTPUT file, as shown in figure 8-1. The entire page is not drawn immediately because this may take several minutes to complete, and user may not wish to see the entire page, or may not wish to look at the first page at all. These first few lines are called a "tease", and are displayed to give the user an indication of the contents of the page. After the "tease" is displayed, PHASOR will display the graphic crosshair cursor and wait for a user input. This input may consist of one of the following GINKS:

(C) which will cause PHASOR to display the rest of the page;
(L) which will cause PHASOR to display part of a page, down to the location of the crosshair cursor;
(P) which will cause PHASOR to display a prompting message for selection of an alternate page;
(/) which will cause PHASOR to return to DIRECTIVE mode.

After PHASOR completes the display selected by a C or L GINK, it will display the prompting message.

PAGE=

at the bottom of the display. At this time, user may enter another page number to be displayed, or may enter a "C", "L", or "/". If a page number is entered, PHASOR will erase the display and display the "tease" of the indicated page. If "C" is entered, the remainder of the present page will be displayed (unless already and end-of-page, in which case the next page will be displayed). If "L" is entered, the crosshair cursors will be displayed so that user may position them to select a portion of the page to be selected for display, as was the case with the original L GINK. If "/" is entered, PHASOR will return to DIRECTIVE mode.

Some examples of PREVIEW control of the display are illustrated on the following pages.

In section 10, options will be described which allow the user to easily select a page other than page 1 for the initial display upon entering PREVIEW mode, and also to modify the number of lines displayed as a tease.

```
JUN 23, 1976      MISD/SEAD REV. 3      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE 1

                                        PHASOR BEGUN AT  09.22.05.

***** //ATTACH,DATA,PHASORDATA,CY=3,ID=CARBREY
```

Figure 8-1. Initial "tease" display. Entering a (C) keystroke at this point will display the rest of the page.

```
        JUN 23, 1976     MISD/SEAD REV. B     ***** PHASOR 1.0 *****     PICATINNY ARSENAL     PAGE 1

                                        PHASOR BEGUN AT  09.22.05.
***** //ATTACH,DATA,PHASORDATA,CY=3,ID=CARBREY
PHASOR ATTACHED FILE DATA     TO CYCLE   3 OF PHASORDATA
***** //READ,DATA
PHASOR READS DATA SET   1 OF FILE DATA
T        81 MM BROM FROM PROMS DECK
U          -2        8       4.5        81 MM PROJECTILE
B
1.0925   1.0925   5.6450    .1000     .5000     FIN1
1.0925   1.1925    .0500    .1000    6.1450     FIN2
1.3138   1.6842   1.1331    .1000    6.2369     FIN4
 .7126    .7126    .6500   -.1000     .5000     -FIN5
 .7126    .6850    .1000   -.1000    1.1500     -FIN6
 .6850    .6850   4.8750   -.1000    1.2500     -FIN7
 .3464   0.0000    .1000   -.1000    6.2100     -FIN9
1.0715   1.0920    .0950   -.1000    6.5450     -FIN11
1.0920   1.0920    .5550   -.1000    6.6400     -FIN12
1.1550   1.1550    .1150   -.1000    7.1950     -FIN13
1.1550   1.2750    .0600   -.1000    7.3100     -FIN14
 .9751   1.0851    .0550    .1000    6.6450     ADAP1
1.0851   1.0851    .5350    .1000    6.7000     ADAP2
1.0851   1.1206    .1000    .1000    7.2350     ADAP3
1.1206   1.1906    .0350    .1000    7.3350     ADAP4
1.4552   1.4552    .2500    .1000    7.3700     ADAP5
1.7079   2.7936   3.5102    .2830    7.3700     BODY1
3.1695   3.1695    .1173    .2830   12.5660     BODY3
3.1695   2.9280    .0697    .2830   12.6833     BODY4
2.9280   2.9280    .1870    .2830   12.7530     BODY5
3.1695   3.1695   1.6185    .2830   12.9400     BODY6
2.7910   2.7910    .1265    .2830   14.5585     BODY7
2.8299   2.8299    .5400    .2830   14.6850     BODY8
2.8299   2.7608    .0950    .2830   15.2250     BODY9
1.4628   1.4628    .3500   -.2830    7.3700     -BODY10
1.4628   1.3000    .1410   -.2830    7.7200     -BODY11
1.3000   1.3000   1.7220   -.2830    7.8610     -BODY12
 .8250    .8250    .0510   -.2830    9.5830     -BODY13
1.9000   2.6815   2.2400   -.2830    9.6340     -BODY14
2.6815   2.6815   3.4460   -.2830   11.8740     -BODY15
1.2500   1.2500   1.9630    .0830    7.6200     FUZE
 .8000    .8000    .5740    .0660    9.5830     BOOSTER
 .4360   2.6815   2.7730    .3220   12.2516     LINER2
2.6815   2.6815    .2954    .3220   15.0246     LINER3
2.7600   2.7600    .0390    .3220
 .3687   2.6035   2.7663   -.3220
2.6035   2.6035    .3265   -.3220
1.[illegible]   2.6815   2.2400    .0652
2.6815   2.6815   3.1506    .0652

PAGE.
```

Figure 8-2. Display after Ⓒ keystroke.

```
JUN 23, 1976      MISD/SEAD REV. B      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE 1

                                       PHASOR BEGUN AT  09.22.05.

***** //ATTACH,DATA,PHASORDATA,CY=3,ID=CARBREV

PHASOR ATTACHED FILE DATA     TO CYCLE   3 OF PHASORDATA

***** //READ,DATA

PHASOR READS DATA SET   1 OF FILE DATA

T         81 MM BROM FROM PROMS DECK
W          -2        8         4.5         81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000       .5000      FIN1
1.0925    1.1925     .0500    .1000      6.1450      FIN2
1.3138    1.6842    1.1331    .1000      6.2369      FIN4
 .7126     .7126     .6500   -.1000       .5000     -FIN5
 .7126     .6850     .1000   -.1000      1.1500     -FIN6
```

Figure 8-3. An L keystroke entered from position of figure 8-1 instead of C would result in this display.

PAGE.

```
JUN 23, 1976      MISD/SEAD REV. B      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE 1

                                        PHASOR BEGUN AT  09.22.05.

***** //ATTACH,DATA,PHASORDATA,CY=3,ID=CARBREY

PHASOR ATTACHED FILE DATA    TO CYCLE   3 OF PHASORDATA

***** //READ,DATA

PHASOR READS DATA SET   1 OF FILE DATA

T         81 MM BROM FROM PROMS DECK
W          -2        8         4.5       81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000     .5000     FIN1
1.0925    1.1925    .0500     .1000     6.1450    FIN2
1.3138    1.6842    1.1331    .1000     6.2369    FIN4
.7126     .7126     .6500     -.1000    .5000     -FIN5
.7126     .6850     .1000     -.1000    1.1500    -FIN6

.6850     .6850     4.8750    -.1000    1.2500    -FIN7
.3464     0.0000    .1000     -.1000    6.2100    -FIN9
1.0715    1.0920    .0950     -.1000    6.5450    -FIN11
1.0980    1.0920    .5550     -.1000    6.6400    -FIN12
1.1550    1.1550    .1150     -.1000    7.1950    -FIN13
1.1550    1.2750    .0600     -.1000    7.3100    -FIN14
.9751     1.0851    .0550     .1000     6.6450    ADAP1
1.0851    1.0851    .5350     .1000     6.7000    ADAP2
```

Figure 8-4. Second "L" entry in response to prompt allows user to indicate how much more of page is to be shown.

```
PAGE=L    PAGE=
```

```
JUN 23, 1976      MISD/SEAD REV. B      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE 1

                                        PHASOR BEGUN AT  09.22.05.

***** //ATTACH,DATA,PHASORDATA,CY=3,ID=CARBREY

PHASOP ATTACHED FILE DATA    TO CYCLE   3 OF PHASORDATA

***** //READ,DATA

PHASOR READS DATA SET   1 OF FILE DATA

T         81 MM BROM FROM PROMS DECK
W          -2        8         4.5        81 MM PROJECTILE
B
1.0925    1.0925    5.6450    .1000      .5000     FIN1
1.0925    1.1925    .0500     .1000      6.1450    FIN2
1.3138    1.6842    1.1331    .1000      6.2360    FIN4
.7126     .7126     .6500     -.1000     .5000     -FIN5
.7126     .6850     .1000     -.1000     1.1500    -FIN6

.6850     .6850     4.8750    -.1000     1.2500    -FIN7
.3464     0.0000    .1000     -.1000     6.2100    -FIN9
1.0715    1.0920    .0950     -.1000     6.5450    -FIN11
1.0920    1.0920    .5550     -.1000     6.6400    -FIN12
1.1550    1.1550    .1150     -.1000     7.1950    -FIN13
1.1550    1.2750    .0600     -.1000     7.3100    -FIN14
.9751     1.0851    .0550     .1000      6.6450    ADAP1
1.0851    1.0851    .5350     .1000      6.7000    ADAP2
```

Figure 8-5. Entering a number instead of "L" in response to "PAGE=" produces the "tease" for the desired page.

```
PAGE=L    PAGE=4
```

```
        JUN 23, 1976      MISD/SEAD REV. 3       ***** PHASOR 1.0 *****      PICATINNY ARSENAL       PAGE  4
                                                      81 MM BROM FROM PROMS DECK

51 BODY     D1=   1.1875 D2=   1.1875  H=     .0500 RHO=   -.0700 REF=  19.3750 ID=-NOSE3
52 BODY            .4900        .4900         .3500         .0700       18.8750    NOSE4
```

Figure 8-6. PHASOR displays the "tease" for the newly selected page.

JUN 23, 1976 MISD/SEAD REV. B ***** PHASOR 1.0 ***** PICATINNY ARSENAL PAGE 4

81 MM BROM FROM PROMS DECK

51	BODY	D1=	1.1875	D2=	1.1875	H=	.0500	RHO=	-.0700	REF=	19.3750			ID=-NOSE3
52	BODY		.4900		.4900		.3500		.0700		18.8750			NOSE4
53	BODY		.9000		.9000		.1700		.0700		19.2250			NOSE5
55	FIN* 6	R1=	1.3700	R2=	1.4350	H=	.0575	RHO=	.1000	REF=	0.0000	TH=	.1000	ID=FIN BL1
56	FIN* 6		1.4350		1.5675		.2750		.1000		.0575		.1000	FIN BL2
57	FIN* 6		1.5675		1.5925		.2750		.1000		.3325		.1000	FIN BL3
58	FIN* 6		1.5925		1.5925		.3850		.1000		.6075		.1000	FIN BL4
59	FIN* 6		1.5925		1.5400		.2500		.1000		.9925		.1000	FIN BL5
60	FIN* 6		1.5400		1.5400		.3700		.1000		1.2425		.1000	FIN BL6
61	FIN* 6		1.5400		1.4950		.1900		.1000		1.6125		.1000	FIN BL7
62	FIN* 6		1.4950		1.3750		.1350		.1000		1.8025		.1000	FIN BL8
63	FIN* 6		1.3750		.6875		.4800		.1000		1.9375		.1000	FIN BL9
64	FIN* 6		.7187		.7187		.5000		-.1000		0.0000		.1000	-FIN BL10
65	FIN* 6		.5900		.5900		1.9175		-.1000		.5000		.1000	-FIN BL11
66	FIN* 6		.5900		.5900		1.9175		.1000		.5000		.1900	FIN BL12
67	FIN* 6		.5462		.5462		1.9175		-.1000		.5000		.1900	-FIN BL13
68	FIN* 6		.5462		.5462		.0904		-.1000		2.7548		.0904	-FIN HOL1
69	FIN* 6		.3425		.3425		.0904		.1000		2.7548		.0904	FIN HOL1
70	FIN* 6		.5462		.5462		.0904		-.1000		3.3548		.0904	-FIN HOL2
71	FIN* 6		.3425		.3425		.0904		.1000		3.3548		.0904	FIN HOL2
72	FIN* 6		.5462		.5462		.0904		-.1000		3.9548		.0904	-FIN HOL3
73	FIN* 6		.3425		.3425		.0904		.1000		3.9548		.0904	FIN HOL 3
74	FIN* 6		.5462		.5462		.0904		-.1000		4.5548		.0904	-FIN HOL4
75	FIN* 6		.3425		.3425		.0904		.1000		4.5548		.0904	FIN HOL 4
76	FIN* 6		.5462		.5462		.0904		-.1000		5.1548		.0904	-FIN HOL 5
77	FIN* 6		.3425		.3425		.0904		.1000		5.1548		.0904	FIN HOL 5
78	FIN* 6		.5462		.5462		.0904		-.1000		5.7548		.0904	-FIN HOL 6
79	FIN* 6		.3425		.3425		.0904		.1000		5.7548		.0904	FIN HOL 6
81	OGIVE 0	A=	-.0500	B=	-.6075	H=	.0419	RHO=	.1000	REF=	6.1950	R=	.0500	ID=FIN3
82	OGIVE 0		0.0000		-.2575		.0850		-.1000		6.1250		.0850	- FIN 8
83	OGIVE 0		-.0400		-.4957		.0400		-.1000		6.5050		.0400	-FIN10
84	OGIVE 0		-3.0568		18.3682		1.6858		.2830		10.8802		20.0000	BODY2
85	OGIVE 0		-.2347		0.0000		.1466		.3220		12.1050		.2347	LINER1
86	OGIVE 0		-.1957		0.0000		.1222		-.3220		12.1440		.1957	-LINER5
87	OGIVE 0		-.2347		0.0000		.1466		-.0652		12.1050		.2347	-OCTOL4
88	OGIVE 0		0.0000		11.4153		4.4165		.2830		14.5585		13.0000	OGIVE 1
89	OGIVE 0		.8005		11.4153		3.4160		-.2830		15.3590		12.7115	-OGIVE 6
90	OGIVE 0		4.4165		11.4153		1.8000		.0700		18.9750		13.0000	NOSE1
92	BODY	D1=	1.2933	D2=	2.2933	H=	1.1400	RHO=	-.2830	REF=	9.5800	ID=		
93	BODY		2.2933		2.6667		1.1533		-.2830		10.7200			

Figure 8-7. © keystroke selects entire page for display.

PAGF=C PAGE=

9. DIRECTIVE MODE

You may recall that the DIRECTIVE mode is the basic operating mode for PHASOR, and that DRAW, EDIT, PREVIEW, TABLET and CALCOMP modes are called from, and return to, DIRECTIVE mode. The user can always ascertain the existence of DIRECTIVE mode because PHASOR always displays the prompting characters,

//

when it is ready for an input in DIRECTIVE mode. Users familiar with INTERCOM will find DIRECTIVE mode similar in syntax and purpose to INTERCOM COMMAND mode. The general format for all DIRECTIVEs is:

DIRECTIVE, parameters, options.

The DIRECTIVE is a keyword selected from the list below:

READ	causes PHASOR to read a local data file and copy it onto the EDIT file for analysis, drawing, etc.
ATTACH	causes PHASOR to attach a permanent file.
SAVE	causes PHASOR to save the contents of the EDIT file on a local data file.
CATALOG	causes PHASOR to make a local data file permanent.
REWIND	causes PHASOR to rewind the specified file.
PUNCH	causes PHASOR to punch a card deck from the EDIT file.
PURGE	causes PHASOR to destroy a permanent file.
RETURN	causes PHASOR to return a file.
?	causes PHASOR to display a list of legal DIRECTIVES and options.
NEW	causes PHASOR to discard the contents of the EDIT file and prepare for a new shell configuration.
EDIT	causes PHASOR to enter EDIT mode.
DRAW	causes PHASOR to enter DRAW mode.
TABLET	causes PHASOR to enter TABLET mode.
PREVIEW	causes PHASOR to enter PREVIEW mode.
CALCOMP	causes PHASOR to enter CALCOMP PLOT mode.
OPTION	causes PHASOR to accept one or more options without executing any specific directive.
STOP	causes PHASOR to halt operation and return to INTERCOM COMMAND mode.
LOGO	causes PHASOR to display the PHASOR logo.
HARDCOPY	causes PHASOR to analyze the shell currently on the EDIT file and print a detailed analysis on file OUTPUT.
SEND	causes PHASOR to send the OUTPUT file to any desired line printer.

Some DIRECTIVES require PARAMETERS to follow the DIRECTIVE name, separated by a comma. For some DIRECTIVES, the PARAMETERS may be optional, and therefore, may be omitted if desired. Parameter requirements are explained for each individual DIRECTIVE in the following sections.

Most DIRECTIVES may be followed by one or more OPTIONS. OPTIONS are never required, but may be specified if desired. OPTIONS are specified in the general format,

OPTION=value

and are separated by commas. For example, in section 2 the DIRECTIVE,

DRAW,VIEW=FULL,RADIAL=OFF

was used to draw the sample shell. This DIRECTIVE had two options specified, VIEW and RADIAL. Options cause PHASOR to alter its normal method of operation. The meaning and application of all options is discussed in section 10.

The following sections examine each DIRECTIVE in detail.

In each section, the underlined portion of the format of the DIRECTIVE indicates an acceptable abbreviation for the DIRECTIVE.

9.1 READ DIRECTIVE.

Purpose: To copy a local data file onto the EDIT file for analysis, editing, drawing, etc.

Format:

```
//READ,lfn
```

Parameters:

lfn is a local file name of the file to be copied.

Applicable options:

DECK, SET, OFFSET.

Discussion:

Before PHASOR can analyze, draw, plot, or otherwise act upon a shell description, the descriptive data cards must exist on a special file called the EDIT file. The READ directive causes PHASOR to copy card images from a file called lfn to the EDIT file. The cards are always added to the end of the existing EDIT file, making it easy to analyze a shell which is a composite of items found on two different files. LFN may be any legal SCOPE file name except those reserved for PHASOR, as listed in Appendix G. LFN is read from the first card, unless SET option is used to specify an alternate data set on the file (see section 10.10).

Examples:

```
//READ,MYDATA
PHASOR READS DATA SET   1 OF FILE MYDATA
23 CARD IMAGES READ.
//
```

In the above example, PHASOR found 23 card images on the file called MYDATA. "DATA SET   1" indicates that PHASOR began reading from the beginning of the file, which is the default position.

```
//READ, XX.
PHASOR READS DATA SET   1 OF FILE XX
   0 CARD IMAGES READ.
//
```

In the above example, user specified an erroneous file name, so PHASOR found no cards on it. User should always check the reply from PHASOR to make sure a reasonable number of cards were read.

9.1 READ DIRECTIVE (continued)

```
//READ, XYZ, DECK=WEIGHT
PHASOR READING DATA SET  1 OF WEIGHT DECK ON XYZ
END-OF-FILE XYZ   AFTER 108 CARD IMAGES.
PHASOR TRANSLATING DECK TO PHASOR FORMAT...
109 CARD IMAGES READ.
//
```

The above example illustrates how PHASOR can be directed to read a data deck generated for a different program, in this case the WEIGHT program. PHASOR can translate WEIGHT or PROMS decks. This feature is discussed in detail in section 10.9. Notice that PHASOR indicated both the length of the original WEIGHT deck (108 cards), and the length of the translated PHASOR deck (109 cards).

```
//READ, MINE,SET=4
PHASOR READING DATA SET  4 OF FILE MINE
20 CARD IMAGES READ.
//
```

The above example illustrates how more than one shell may be stored on a single file. In this case, PHASOR was directed to read the fourth data set on the file called MINE. PHASOR therefore began reading after the third END statement encountered on the file, and found 20 card images on the fourth file.

These examples have been provided to help introduce the concept of options. More options for READ directives are provided and discussed in section 10.

9.2 ATTACH DIRECTIVE

Purpose: To attach a permanent file.

Format:

//ATTACH,lfn,pfn,ID=name,CY=n

Parameters:

lfn is the local file name to be used.

pfn is the permanent file name to be used.

name is the owner ID of the permanent file

n is the cycle number of the permanent file.

ALL PARAMETERS ARE REQUIRED.

Applicable options: none

Discussion: This DIRECTIVE functions in the same manner as the SCOPE INTERCOM ATTACH, with the following exceptions:

1. All parameters are required as shown above; none may be omitted.
2. Passwords may not be specified.

Users not familiar with the INTERCOM ATTACH command should read appendix B of this manual and section 5-8 of reference 1.

Examples:

```
//ATTACH,MINE,XM650E1DATA,ID=SMOLNIK,CY=1
//
```

The above example attaches a permanent file named XM650E1DATA and gives it the local file name of MINE. To read this file for evaluation, user could enter,

//READ,MINE

9.3 SAVE DIRECTIVE

Purpose: To copy the contents of the EDIT file to a local file specified by user.

Format:

//SAVE,lfn

Parameters:

lfn is the local file name desired.

Applicable Options: DECK

Discusson: This directive performs a function that is analagous to the SAVE command under CDC's EDITOR. The current contents of the EDIT file are copied onto the named local file. PHASOR will automatically insure that this file is created on a permanent file device, so that it may be cataloged directly, if desired.

Example:

User has constructed a model of the XM107 using the graphics tablet, and now wishes to save his new data base permanently. After returning to DIRECTIVE mode, he types,

```
//SAVE,DBASE
PHASOR SAVED 112 CARD IMAGES ON FILE DBASE
REQUEST,DBASE,*PF.
//     CATALOG,DBASE,XM107DATABASE,ID=HUTCH,CY=1
CT ID=HUTCH  PFN=XM107DATABASE
CT CY=001  00000768 WORDS:
//
```

The line reading "REQUEST,DBASE.*PF" is an acknowledgement from the operating system in response to PHASOR's request for a permanent file device for DBASE, and was not typed by user. After this sequence, user's new data base is stored on disk and may be retrieved during another interactive session by using the ATTACH directive.

9.4 CATALOG DIRECTIVE

Purpose: To make a local file permanent.

Format:

//CATALOG,lfn,pfn,ID=name,CY=n

Parameters:

lfn is the local file name to be cataloged.

pfn is the permanent file name to be assigned.

name is the owner's ID for the file.

n is the cycle number to be used.

Applicable options: none

Discussion: This directive functions in the same manner as the SCOPE INTERCOM CATALOG command, with the following exceptions:

1. All parameters are required.
2. Passwords may not be specified.

Users not familiar with the INTERCOM CATALOG command should read appendix B of this manual and section 5-8 of reference 1.

Example:

```
//CATALOG,NEW,NEWDATA,CY=2,ID=STARSKY.
  CT ID=STARSKY PFN=NEWDATA
  CT CY=001  00000768WORDS
//
```

The above DIRECTIVE will cause PHASOR to issue a request to the operating system that the local file named NEW be retained permanently under the ID of STARSKY, in cycle number 2 with the permanent file name NEWDATA. After user logs out, the file will be retained, and may be retrieved subsequently by an ATTACH directive, for example:

//ATTACH,OLD,NEWDATA,CY=2,ID=STARSKY.

The same file that was called NEW when cataloged will now be available under the local file name OLD.

9.5 REWIND DIRECTIVE

Purpose: To rewind a local file.

Format:

//REWIND,lfn

Parameters:

lfn is the local file name to be rewound.

Applicable options: none

Discussion: This directive is provided as a convenience to the user to rewind any local file. Since PHASOR automatically rewinds any local file before it performs any action on the file, it is not necessary to use REWIND before READ, SAVE, etc.

Example:

//REWIND,ABC

//REWIND,OUTPUT

The OUTPUT file mav be rewound to discard all outout on the OUTPUT file up to that point in time.

9.6 PUNCH DIRECTIVE

Purpose: To produce a punched deck of the current EDIT file.

Format:

//PUNCH

Parameters: none

Applicable options: **DECK**

Discussion: Any data base for PHASOR may be permanently saved on punched cards by using the PUNCH DIRECTIVE while the desired data base is in the EDIT file. The punched deck will be prepared automatically at the central site in building 351. It should be noted that the deck will begin punching immediately at the time the PUNCH directive is entered, and not at the end of the job. A complete separate deck will be produced for each PUNCH DIRECTIVE. As an identification aid, PHASOR will punch a unique job name on the first card of each punched deck, and will display what this job name will be (unlike the INTERCOM DISPOSE command, which always punches jobs with the same name).

Example:

```
//PUNCH
PHASOR WILL PUNCH 45 CARDS.
PUNCHED DECK NAME WILL BE JHJH138
//PUNCH
PHASOR WILL PUNCH  45 CARDS
PUNCHED DECK NAME WILL BE JHJHI39
//
```

The above example causes two identical dekcs to be punched.

9.7 PURGE DIRECTIVE

Purpose: To make a permanent file non-permanent.

Format:

//PURGE,lfn

Parameters:

lfn is the local file name to be made non-permanent.

Discussion: This DIRECTIVE performs the same function as the SCOPE INTERCOM PURGE COMMAND. The local file name specified must be a permanent file before the directive is issued. After the directive, the named file will no longer be permanent.

Applicable options: none

Example:

User wishes to destroy his existing data base called M106OLD. He may do this as follows:

```
//ATTACH,OLD,M106OLD,ID=MCMILLAN,CY=1
//PURGE,OLD
PR ID= MCMILLAN PFN=M106OLD
PR CY= 001  00000256 WORDS
//RETURN,OLD
//
```

The two lines following the PURGE directive are a system acknowledgement of the completed purge. The RETURN directive is used to relinquish the local file OLD, which still exists after the purge.

9.8 ? DIRECTIVE

Purpose: To display a list of legal directives and options.

Format:
//?

Discussion: Entering a question mark while in directive mode will cause PHASOR to display a brief list of legal directives and their meanings. After the list is displayed, PHASOR will ask the user if he also wishes to see a list of options. If the user answers "YES", a brief list of options (as discussed in section 10) will also be displayed.

9.9 NEW DIRECTIVE

Purpose: To discard the existing EDIT file and prepare for a new configuration.

Format:

//NEW

Parameters: none

Applicable options: none

Discussion: This is an important directive which tells PHASOR to start a new shell and discard the old shell, if any.

Example:

User has been analyzing the M106 shell. He now wishes to read an existing data file for the XM650. To do so, he may enter:

```
//NEW
//ATTACH,NEWD,XM650DATA,ID=BKNIGHT,CY=3.
//READ,NEWD
PHASOR READING DATA SET   1 OF FILE NEWD
38 CARD IMAGES READ
//
```

Note that if the NEW directive had been omitted from the above sequence, PHASOR would have appended the cards on file NEWD to the end of the EDIT file, and PHASOR would have been ready to draw or analyze both shells together!

9.10 EDIT DIRECTIVE

Purpose: To enter EDIT mode.

Format:

//EDIT

Parameters: none

Applicable options:

PAGE, FIRST, START

Discussion: Entering an EDIT DIRECTIVE will cause PHASOR to erase the screen and enter EDIT mode. EDIT mode is discussed in detail in section 6. The PAGE and FIRST options may be selected to be specified; these are discussed in section 10.

Example:

//EDIT

9.11 DRAW DIRECTIVE

Purpose: To enter DRAW mode

Format:

//DRAW

Parameters: none

Applicable options:

RADIAL, XMIN, XMAX, VIEW, YOVERX, XSNAP, YSNAP,
YMIN, XTIC, YTIC, XTLI, YTLI

Discussion: The DRAW DIRECTIVE causes PHASOR to erase the screen and enter DRAW mode, as discussed in section 5. A number of options are available for altering the type of display generated, aspect ratio of the axes, tic marks and labels, etc., and these are discussed in section 10.

Examples:

//DRAW

This causes execution of draw mode with default values.

9.12 TABLET DIRECTIVE

Purpose: To enter TABLET mode.

Format:

//TABLET

Parameters: *none*

Applicable options:

SETUP, XMIN, XMAX, YOVERX, XSNAP, YSNAP

Discussion: Entering TABLET will cause PHASOR to erase the screen and prepare the graphics tablet for entry of data. A number of options are available, and are discussed in section 10. Tablet mode is discussed in detail in section 7.

Example:

//TABLET

9.13 PREVIEW DIRECTIVE

Purpose: to enter the PREVIEW mode.

Format:

//PREVIEW

Parameters: none

Applicable options:

PAGE, FIRST, START, TEASE

Discussion: Using the PREVIEW DIRECTIVE will cause PHASOR to erase the screen and enter the PREVIEW mode to allow user to display the contents of the OUTPUT file. A number of options are available for preview mode, and are discussed in section 10. PREVIEW mode is discussed in section 8.

Example: //PREVIEW

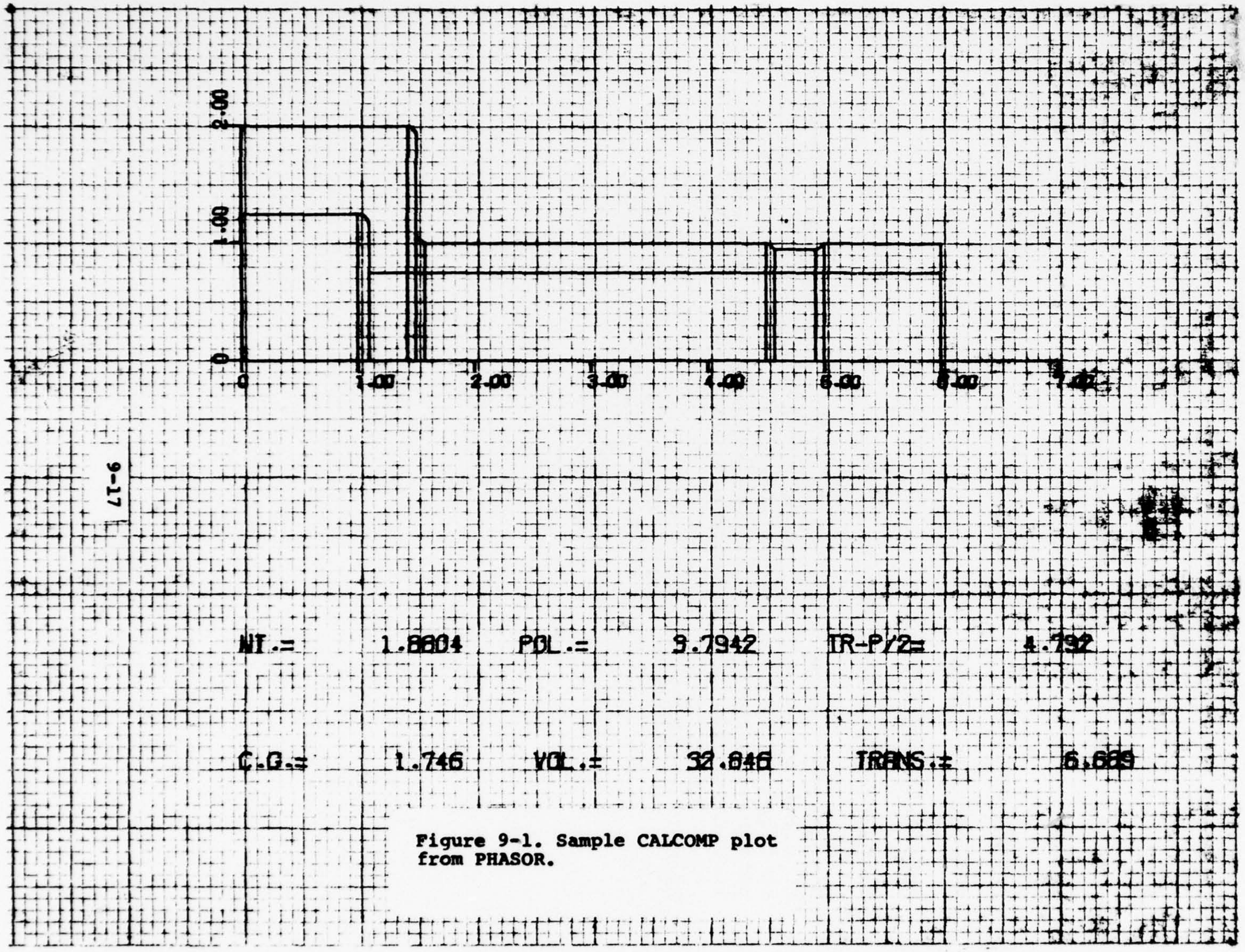


Figure 9-1. Sample CALCOMP plot from PHASOR.

9.14 CALCOMP DIRECTIVE

Purpose: To make a CALCOMP plot

Format:

//CALCOMP

Parameters: none

Applicable options

RADIAL, XMIN, XMAX, VIEW, YOVERX, YMIN, SCALE

Discussion: Using the CALCOMP DIRECTIVE will cause PHASOR to prompt user to enter certain required information so as to make a calcomp plot. PHASOR then returns to DIRECTIVE mode, while simultaneously a magnetic tape is generated for later production of the finished plot. As an aid to identiification of the plot, a unique plot job name will be placed on the plot and displayed at the screen by PHASOR. Each CALCOMP DIRECTIVE will produce a new plot.

Example:

```
//CALCOMP
ENTER VALID BILLING CODE FOR PLOT JOB
(FORMAT=XXX-YYY)=738-017
ENTER YOUR LAST NAME, 1ST INITIAL=MILLER,B
JOB NAME WILL BE JHJHI40.
//
```

This dialog will cause a plot of the contents of the EDIT file to be made. The plot will be labelled "JHJHI40" for ease of identification when retrieved from the central site in building 351.

HOUSTON BINARY plots are not supported.

The ability to make CALCOMP plots from an interactive program is unique to PHASOR. At the time of publication, no other interactive program at Picatinny is capable of producting a CALCOMP plot directly.

A sample CALCOMP plot is shown in figure 9-1. This plot was produced by specifying the VIEW and RADIAL options on the CALCOMP directive (see sections 10.8 and 10.3).

9.15 OPTION DIRECTIVE

Purpose: To set an optional parameter without other action.

Format:

//OPTION

Parameters: none

Applicable options:

PAGE, FIRST, RADIAL, SETUP, XMIN, XMAX, SCALE, VIEW
DECK, SET, OFFSET, START, TEASE, YOVERX, XSNAP, YSNAP
XTIC, YTIC, TMIN, XTLI, TYLI

Discussion: This directive may be used to preset default values for certain desired options. These options are discussed in section 10. No other action takes place.

Example:

//OPTION,YOVERX=1.0343,XSNAP=.005,YSNAP=.005

The above directive causes PHASOR to preset the YOVERX option to 1.0343, the XSNAP and YSNAP options to .005. The meaning of these and other options is discussed in section 10.

9.16 STOP DIRECTIVE

Purpose: To stop PHASOR execution and return to COMMAND mode.

Format:

//STOP

Parameters: none

Applicable options: none

Example:

//STOP

```
     STOP PHASOR - NORMAL TERMINATION
13.232 CP SECONDS EXECUTION TIME

COMMAND -
```

9.17 LOGO DIRECTIVE

Purpose: To display the PHASOR logogram

Format:

//LOGO

Parameters: none

Applicable options: none

Discussion: This DIRECTIVE causes PHASOR to erase the screen and draw the PHASOR insignia, suitable for introducing a demonstration.

9.18 HARDCOPY DIRECTIVE

Purpose: To analyze the contents of the EDIT file and produce complete output on file OUTPUT.

Format:

//HARDCOPY

Parameters: none

Applicable options: none

Discussion: This DIRECTIVE performs the same function as the H GINK in DRAW mode, except that no display is produced. It is provided in order to give the user the ability to get quick printed results without having to wait for PHASOR to draw the DRAW mode display first.

Example:

//HARDCOPY

9.19 SEND DIRECTIVE

Purpose: To send the current OUTPUT file to a line printer at the central site or any remote printer.

Format:

//SEND,xxx
or
//SEND

Parameters:

xx is the SCOPE INTERCOM terminal ID of the selected printer.

Discussion: As discussed in section 8, "Preview Mode", and section 13, "Printed Hardcopy", PHASOR generates a brief chronology of events and detailed results in the OUTPUT file. The OUTPUT file can be sent to any line printer for immediate printing by using the SEND directive. The SEND directive can be used as many times as desired; all OUTPUT generated since the last SEND directive will be printed at the designated terminal. At the time of publication, terminal ID's include:

C	Central Site, Bldg 351
ACI	1700 Room, Bldg 353*
AC	Bldg 62
AD	Bldg 65
AG	Bldg 94
AE	Bldg 266
AF	Bldg 3359
BZ	Bldg 171
AI	Bldg 351

If no ID is specified, PHASOR will print a list of current ID's from which the user may select. A sample SEND is illustrated in Figure 9-2.

*NOTE: "ACI" is used by PHASOR to differentiate between "AC" on mainframe 65I and "AC" on mainframe 66B.

```
//SEND
CHOOSE ID = C (BLDG 351), ACI(353), AC(62), AD(65), AG(94),
AE(266), AF(3359), BZ(171), OR AI(351). ID=     ACI
```

Figure 9-2. PHASOR can be directed to SEND the OUTPUT file to a line printer.

OPTION KEYWORD	EFFECTED DIRECTIVES								PERSISTENCE
	READ	SAVE	PUNCH	EDIT	DRAW	TABLET	PREVIEW	CALCOMP	
PAGE				X			X		Until //NEW
FIRST				X			X		Until //NEW
RADIAL					X			X	Until //NEW
SETUP						X			Until //NEW
XMIN					X	X		X	Until //NEW
XMAX					X	X		X	Until //NEW
SCALE								X	Until //NEW
VIEW					X			X	Until //NEW
DECK	X	X	X						This directive only
SET	X								This directive only
OFFSET	X								This directive only
START				X			X		Until //NEW
TEASE							X		Until //NEW
YOVERX								X	Permanent
XSNAP					X	X			Until //NEW
YSNAP					X	X			Until //NEW
XMIN					X			X	Until //NEW
XTIC					X	X			Until //NEW
YTIC					X	X			Until //NEW
XTLI					X	X			Until //NEW
YTLI					X	X			Until //NEW

Figure 10-1. Table showing which DIRECTIVES are effected by various OPTIONS.

10. DIRECTIVE OPTIONS

Section 9 listed the basic DIRECTIVEs which are available to control PHASOR's processing sequence, and detailed the required parameters for each DIRECTIVE. In this section, a list of OPTIONS will be introduced for use with DIRECTIVES. These options may be specified or omitted at the whim of the user. If omitted, the default values preset for PHASOR will be used for the unspecified parameter. The general format for a DIRECTIVE is:

DIRECTIVE, parameters, options

where DIRECTIVE is the command keyword for the activity to be performed, parameters are any required parameters, and options are specified optional keyword=value pairs, for instance:

READ, MYFILE,DECK=PROMS,SET=3,OFFSET=23.454

In this example, "READ" is the directive, "MYFILE" is the required parameter (logical file name), and the remainder of the line specifies three options: (1) That the file to be read conforms to the "PROMS" program input format, (2) That the data base to be used is the third data set on the file, and (3) That the origin of the shell on the data file is to be offset by 23.454 inches to the right during the read-in process. The exact meaning of these options will be explained in more detail later.

Options are always specified in the form,

KEYWORD=VALUE

Where KEYWORD is the name of the desired option, as listed in this chapter, and VALUE is the attribure to be assigned to the named option. As many KEYWORD=VALUE pairs may be included in the directive as desired.

Figure 10.1 contains a list of all option keywords available, and the directives they effect. Any directives not listed in the table are uneffected by options.

Note that the table in figure 10.1 also has a column labelled "PERSISTENCE". This column tells how long the option remains in effect, once it is specified.

Any option may be reset at any time by re-specifying the option. Otherwise, the option remains as set until the condition in the "PERSISTENCE" column is met. Most options are persistent "Until //NEW". This means that the option remains in effect until the next //NEW DIRECTIVE (or N GINK in DRAW mode) is given; at that point PHASOR sets the option back to its default value. The "DECK", "SET", and "OFFSET" options have a persistence listed as "This directive only". This means that the specified option remains in effect only until the DIRECTIVE on which the options are specified is processed. Thereafter, the option will automatically return to the default value. "YOVERX" is the only option listed which has a "permanent" persistence. Once specified, the value given for "YOVERX" will remain in effect permanently (unless respecified by another "YOVERX=VALUE" on another DIRECTIVE).

Options may be specified on any DIRECTIVE except ATTACH and CATALOG. However, they will only have an effect on the DIRECTIVES indicated in the table.

The following sections explain the purpose of each option, and give the legal VALUES which may be associated with a given option, as well as the default value.

10.1 PAGE OPTION

Purpose: To alter the number of card images displayed as one page during EDIT mode.

Format: PAGE=n

where n is an integer number between 3 and 30, designating the number of card images to be displayed at once during EDIT mode.

Default value: PAGE=20

NOTE: If the "PAGE=n" option is specified on a PREVIEW DIRECTIVE, it is interpreted the same as START=n option.

Example:

User wishes to enter EDIT mode, but desires to have smaller display pages than the default size of 20, because it takes the TEKTRONIX terminal a considerable amount of time to display 20 card images at 300 baud. User, therefore types,

//EDIT,PAGE=10

which will cause PHASOR to enter EDIT mode with a display page size of 10 instead of 20 card images. PHASOR, therefore, erases the screen and displays cards 1 through 10 of user's EDIT file.

10.2 FIRST OPTION

Purpose: To designate the first card image to be shown during EDIT mode.

Format: FIRST=n

where n is any positive integer, designating the desired card number.

Default value: FIRST=1.

NOTE: If "FIRST=n" option is specified on a PREVIEW DIRECTIVE, it is interpreted the same as "START=n".

Example:

User wishes to enter EDIT mode to examine the contents of his EDIT file. User knows that he wants to look at the fiftieth card on the EDIT file, and that he wants only 15 cards displayed at a time. Therefore, he enters,

//<u>EDIT,PAGE=15,FIRST=50</u>

PHASOR will release the screen and display card images for card numbers 50 through 64 in response. If user had omitted the "PAGE=15" options, PHASOR would display cards 50 through 69, since the default page size is 20.

10.3 RADIAL OPTION

Purpose: To turn on or off the automatic drawing of radial lines at the ends of BODY, FIN and OGIVE items.

Format: RADIAL=ON
or
RADIAL=OFF

Default value: RADIAL=ON

Discussion: Figure 10.2 shows a DRAW mode display in the normal format (RADIAL=ON). Figure 10-3 shows the same data displayed with "RADIAL=OFF" option specified on the DRAW DIRECTIVE. Notice that the vertical lines normally drawn from the ends of each item to the centerline are absent. This is the effect of the "RADIAL=OFF" option.

This option may seem of dubious value from figure 10-3. However, if you examine figure 10-4, which was also made using "RADIAL=OFF" you will notice that the display is enhanced because only the radial lines at the ends of the physical shell are drawn in. This kind of display is highly desirable for inclusion in reports or other presentations, since the actual cross-section of the shell is more clearly displayed. In order to display a shell with only certain radial lines drawn, a special format is used for the input. This is the conditional radial line format.

CONDITIONAL RADIAL LINE FORMAT ON THE DATA FILE:

Figure 10-5 shows a listing of the data file used to create the display of figure 10-4. Notice that certain numbers in the first two columns are followed immediately by an asterisk (*). This asterisk is the conditional radial line flag character for PHASOR. When PHASOR draws a display with the "RADIAL=OFF" option specified, it will not draw the radial lines EXCEPT when the asterisk follows the diameter or radius data column. If the asterisk follows the "D1" field, the radial line at the left end of the item will be drawn; if the asterisk follows the "D2" field, then the right hand radial line will be drawn. The asterisk must follow the numeric data immediately, with no blanks between the last numeric digit and the asterisk. If "RADIAL=ON" is specified, all radial lines are drawn, regardless of asterisks.

Example:

Assume the following body cards are on the EDIT file, and that user enters:

//DRAW,RADIAL=OFF

Data Cards	Remarks
B	
2.0* 2. 2. .1 0.	Left radial line only
2, 1., 1 .1 2	No radial lines
1. 1* , 1.0, .1,3.	Right radial line only
1.* 1.* 1. -.1 1.	Left and Right radial line

The resulting figure is shown in figure 10-6, and the EDIT File in figure 10-7.

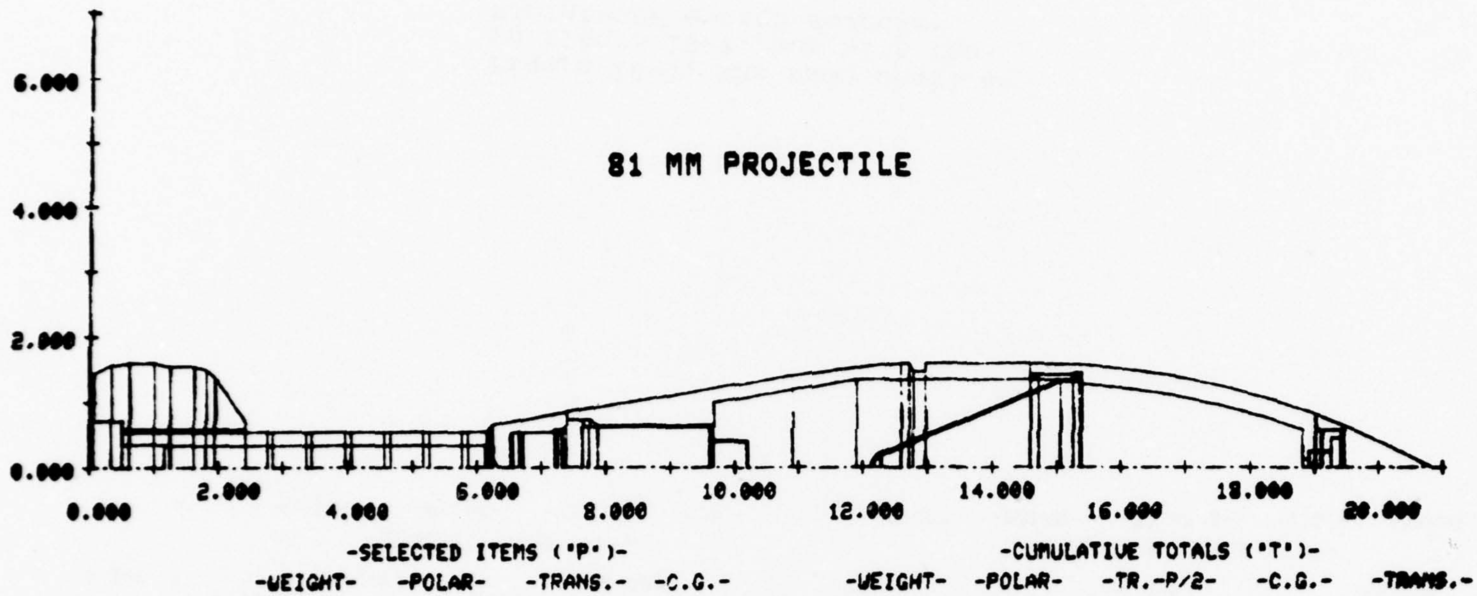


Figure 10-2. A sample shell with default condition for radial lines selected (RADIAL=ON).

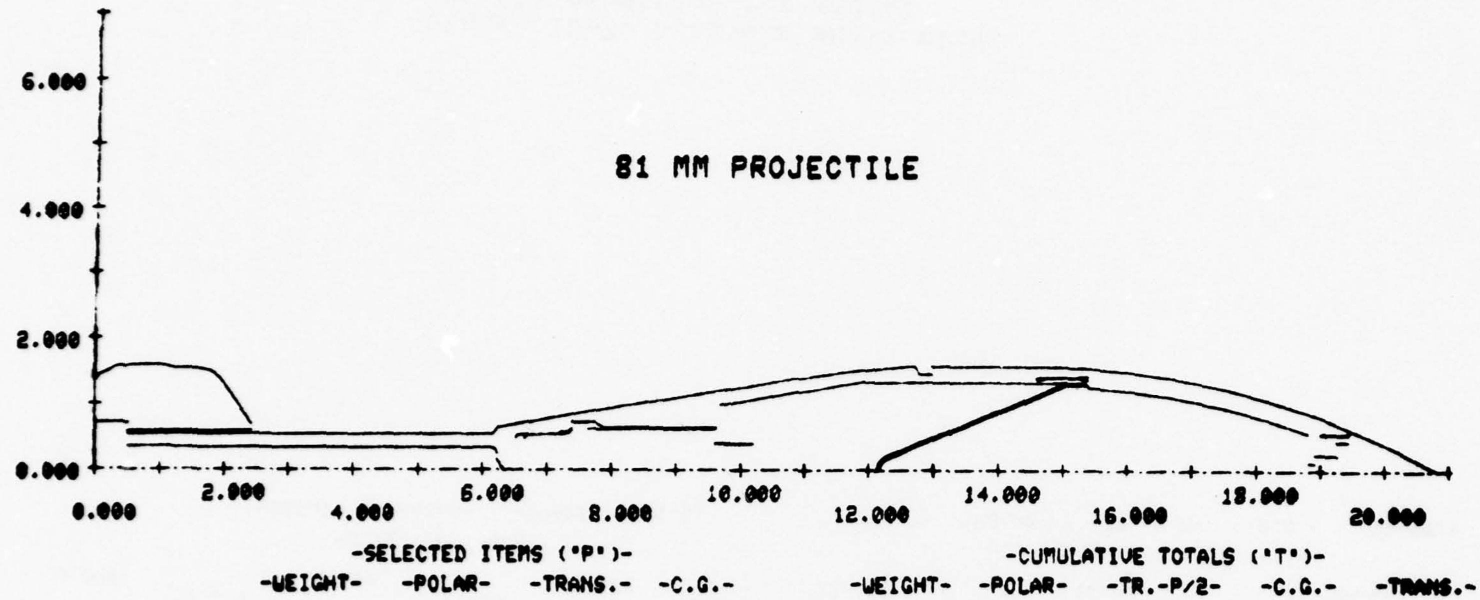


Figure 10-3. The same shell as in figure 10-2, but with the RADIAL=OFF option selected.

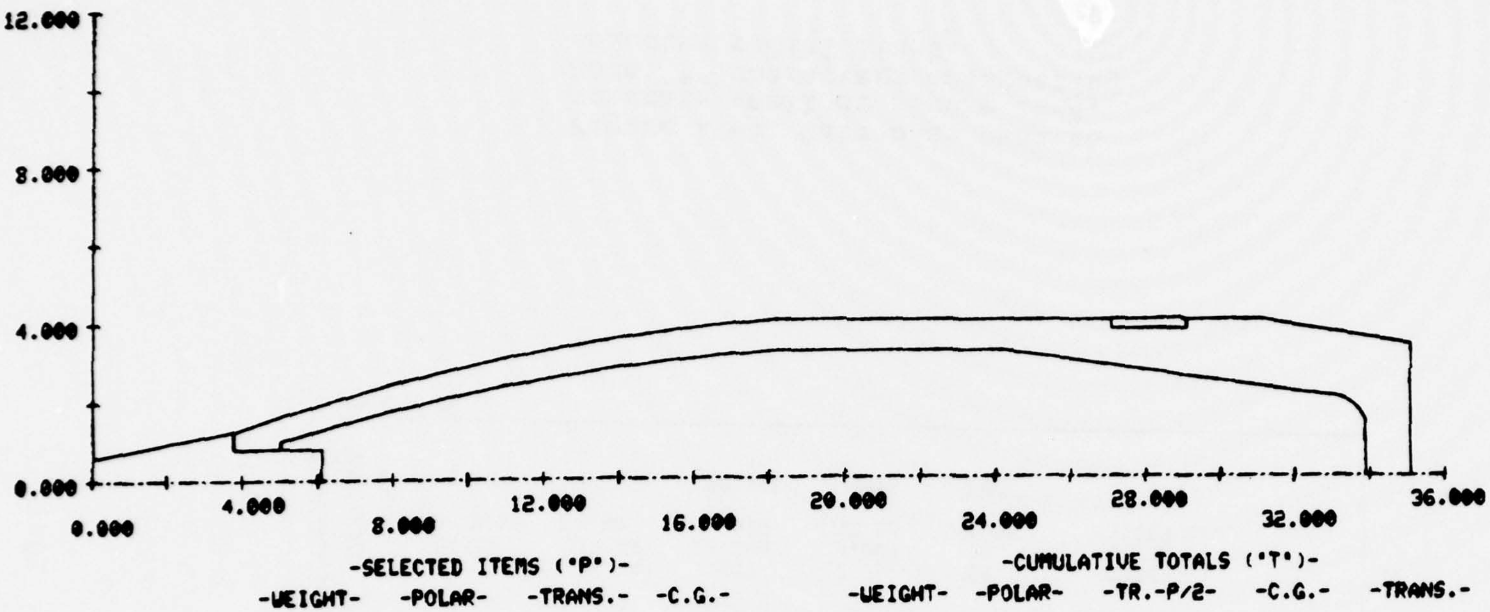


Figure 10-4. A sample shell drawn with RADIAL=OFF option in effect, and using conditional radial lines as indicated in the data base of figure 10-5.

```
( 1)
T         SAMPLE 8 INCH PROJECTILE DATA BASE (HYPOTHETICAL)
B
1.60      2.51       0.0        0.283      3.76       EDGE
7.96      7.96       8.90       .283       18.20      BODY
7.96      7.50       0.0        .283       27.10      BODY
7.50      7.50       2.00       .183       27.10      BODY-BAND
7.50      7.96       0.0        .283       29.10
7.96      7.96       2.0        .283       29.10      BODY
7.96      6.72*      4.0        .283       31.10      BOATTAIL
6.40      6.40       6.0        -.223      18.20      -BODY+FILLER
6.40      4.1        8.80       -.223      24.20      -BODY +FILLER
1.60      1.60       1.24       -.283      3.76       -BODY
1.60      2.00       0.         -.283      5.0        EDGE
1.60      1.60*      1.10       -0.06      5.00       -FILLER
7.96      7.98       0.0        .10        27.10      BAND EDGE
7.98      7.98       .9         .10        27.10      BAND
7.98      8.04       1.0        .10        28.00      BAND
8.00      7.96       0.10       .10        29.00      BAND
1.21      2.51       3.76       0.0        0.0        FUZE OUTLINE
G
2.51      7.96       14.44      .283       3.76       60.        OGIVE
2.00      6.40       13.20      -.223      5.00       60.        -OGIVE
4.10      2.80*      0.90       -.223      33.00      1.00       FILLET
K
2.10      3.16       5.36       30.855     7.886      FUZE
*EOF
( 25 OF  25)
```

Figure 10-5. Data base used to generate shell of figure 10-4. Note "*" characters designating selected radial lines.

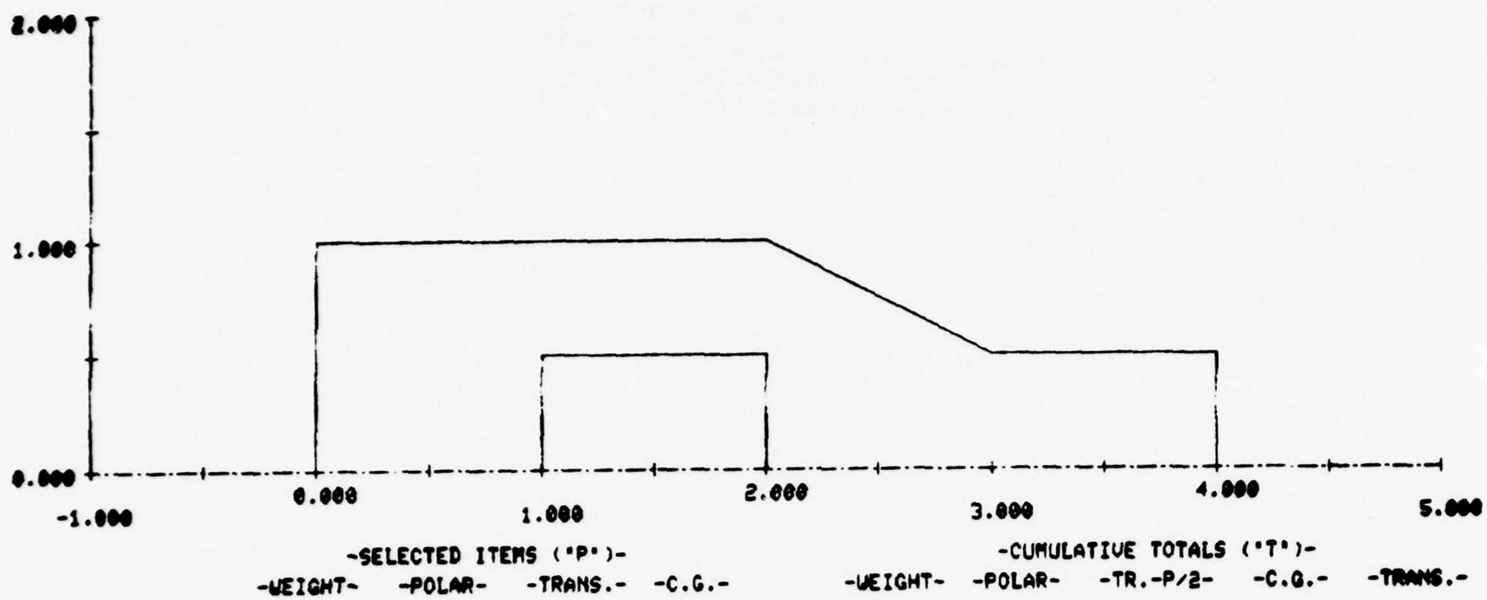


Figure 10-6. Simple shell drawn with RADIAL=OFF option in effect using data base of figure 10-7.

```
( 1)
8
2.0*      2.      2.      .1      0.
2         1.      1       .1      2
1.        1*      1.0     .1      3.
1.*       1.*     1.      -.1     1.
*EOF
( 5 OF  5)
```

Figure 10-7. Data base with conditional radial lines specified, generating display of figure 10-6.

10.4 SETUP OPTION

Purpose: To turn on or off the tablet setup procedure upon entering TABLET mode.

Format: SETUP=ON
or
SETUP=OFF

Default value: SETUP=ON

Discussion: Normally, when a TABLET directive is processed, PHASOR will begin a dialog with the user to calibrate the graphics tablet. This dialog begins with PHASOR prompting,

TABLET INITIALIZATION. ENTER LOGICAL VALUE OF XMIN=

This tablet calibration procedure enables PHASOR to digitize points from the tablet in user's coordinate system. Suppose, however, that after entering some points, user returns to DIRECTIVE mode to perform analysis, edit the data, etc. If user decides to re-enter TABLET mode to digitize more points, PHASOR will begin the entire calibration procedure again. This is not necessary, however, if user is using the same drawing, since PHASOR already has calibrated the tablet once for this drawing. By specifying "SETUP=OFF", user can by-pass the calilbration dialog. PHASOR will use the last calibration data it received.

Example:

User has previously digitized a portion of his shell from the tablet. He then re-entered DIRECTIVE mode, and EDIT mode, to correct some erroneous entries. After re-returning from EDIT mode to DIRECTIVE MODE, user is ready to re-enter TABLET mode to digitize the remainder of his shell. Since he does not want to repeat the tablet initialization again, user types,

//<u>TABLET,SETUP=OFF</u>

10.5 XMIN OPTION

Purpose: To specify the smallest X-value (reference) to be displayed or plotted.

Format: XMIN=value
or
XMIN=?

Where value is any number, and ? is the character "?". If the form, "XMIN=value" is selected, PHASOR will construct the display so that the number "value" will be approximately at the left end of the axis. However, if "value" does not lend itself to "neat" axis tic marks, PHASOR may round the axis endpoint downward somewhat so as to give "neat" tic marks.

If the "XMIN=?" form is selected, PHASOR will draw the axis lower limit such that all items on the EDIT file will have their references to the right of the left axis, and "neat" tic intervals will be made.

Default value:

(a) If this is the first DRAW, TABLET or CALCOMP directive since the beginning of the program, or since the last //NEW directive, then "XMIN=?" is the default.

(b) If this is not the first DRAW, TABLET, or CALCOMP DIRECTIVE, then XMIN is set to the value previously used.

(c) If XMIN=? is selected or taken by defualt, and no data exists on the EDIT file, then XMIN=0.

Discussion:

The XMIN option may seem confusing and complicated, but it is really just a logical attempt to "human engineer" PHASOR. The following discussion also applies to XMAX option.

Normally, you wouldn't specify XMIN or XMAX when drawing a shell. In this case, PHASOR will draw the shell so that the whole shell will fit in the display, regardless of the dimensions of the shell. Furthermore, it will draw it so as to have reasonable tic marks and labels. For instance, if the shell starts at X=0 and extends to X=22.134 PHASOR will make the end points of the plot 0 and 24. Once 0 and 24 are established as the endpoints, they remain so until you specify them differently, or a new shell is begun.

Suppose you want to "zoom" in on a specific part of the shell, for example, from X=12 to X=18. All you do is specify, "XMIN=12,XMAX=18". If you specify endpoints which don't lend themselves to neat axis tic marks, such as "XMIN=11.46, XMAX=17.977", PHASOR will round the endpoints so as to give neat tic marks, for instance XMIN=11 and XMAX=18. Note that PHASOR always rounds the axis endpoints "outward", so that the specified points are always included in the display.

If you enter, "XMIN=? ,XMAX=?", you are merely telling PHASOR to re-compute the endpoints of the axis so everything on the shell will fit in. You might use this form after a zoom when you wish to return to a full-view.

Special conditions: Note that when PHASOR scans the EDIT file data to determine the axis endpoints for "XMIN=?" and/or "XMAX=?", it will construct the axis endpoints so that the entire shell will fit on the screen, both in the X and Y direction. Therefore, if you have a shell that is only 6 inches long but 12 inches in diameter, you may find that PHASOR selected XMAX=10, instead of 6, because it could not fit the entire diameter of the shell in the display when X=6.

Exception: When considering ogives, PHASOR will only consider the endpoints of the ogive when calculating endpoints for the axis. Therefore it is possible to construct an ogive where the endpoints of the ogive are in the display, but the bulge of the curve might lie off the display.

10.6 XMAX OPTION

Purpose: To specify the largest X-value to be displayed or plotted.

Format: XMAX=value
or
XMAX=?

Where value is any number and ? is the character "?". If the form "XMAX=value" is selected, PHASOR will construct the axis endpoints such that the right end of the axis will be approximately at "value". However, if "value" does not lend itself to "neat" tic marks, PHASOR will round "value" up somewhat so as to make neat tic marks.

If the form "XMAX=?" is selected, PHASOR will draw the axis upper limit such that all items on the EDIT file will have their right endpoints to the left of the end of the axis.

Default value: See rules for default value of XMIN, section 10.5.

Discussion: See discussion for XMIN, section 10.5

10.7 SCALE OPTION

Purpose: To set scaling factor for CALCOMP plots.

Format: SCALE=value

where value is any positive number designating the ratio of physical dimensions of the plot to dimensions on the EDIT file.

Default value: SCALE=1.0

Example:

For a small projectile, user wishes to make a CALCOMP plot that is four times actual scale for the shell. Furthermore, user only wishes the section of the shell from X=1.0 to X=2.0 to be plotted. User types,

//CALCOMP,XMIN=1,XMAX=2.,SCALE=4

When the CALCOMP plot is completed, it will have an X axis that is 4 inches long, with the left end labelled "1.0" and the right end labelled "2.0"

NOTE: If an attempt is made to make a plot with a scale so large that the size of the plot would go off the plotting paper or exceed the current system length limit, PHASOR will automatically reduce the plot size until it will fit in the available space. The maximum allowable size is 60 inches long by 24 inches high.

10.8 VIEW OPTION

Purpose: To select "half-shell" or "whole-shell" display or plot of shell.

Format: VIEW=HALF
VIEW=FULL
or
VIEW=WHOLE

where the first forms selects a "half-shell" view, where only the upper half of the shell is shown, and the second two forms select "full-shell" view, with both upper and lower halves displayed.

Default value: VIEW=HALF

Example: Figure 10-8 illustrates a sample shell drawn in the defualt VIEW mode. By typing,

//DRAW,VIEW=FULL

the display of figure 10-9 was obtained.

NOTES:

1. If VIEW=FULL is elected at the same time as YMAX=value, where value is greater that 0, whichever of these two conflicting options was set last will take precedence.

2. Selecting YMIN=value where value is less than zero always implies VIEW=FULL.

3. Selecting YMIN=0 always implies VIEW=HALF.

These three restrictions also apply to zooming using the Z GINK in DRAW mode.

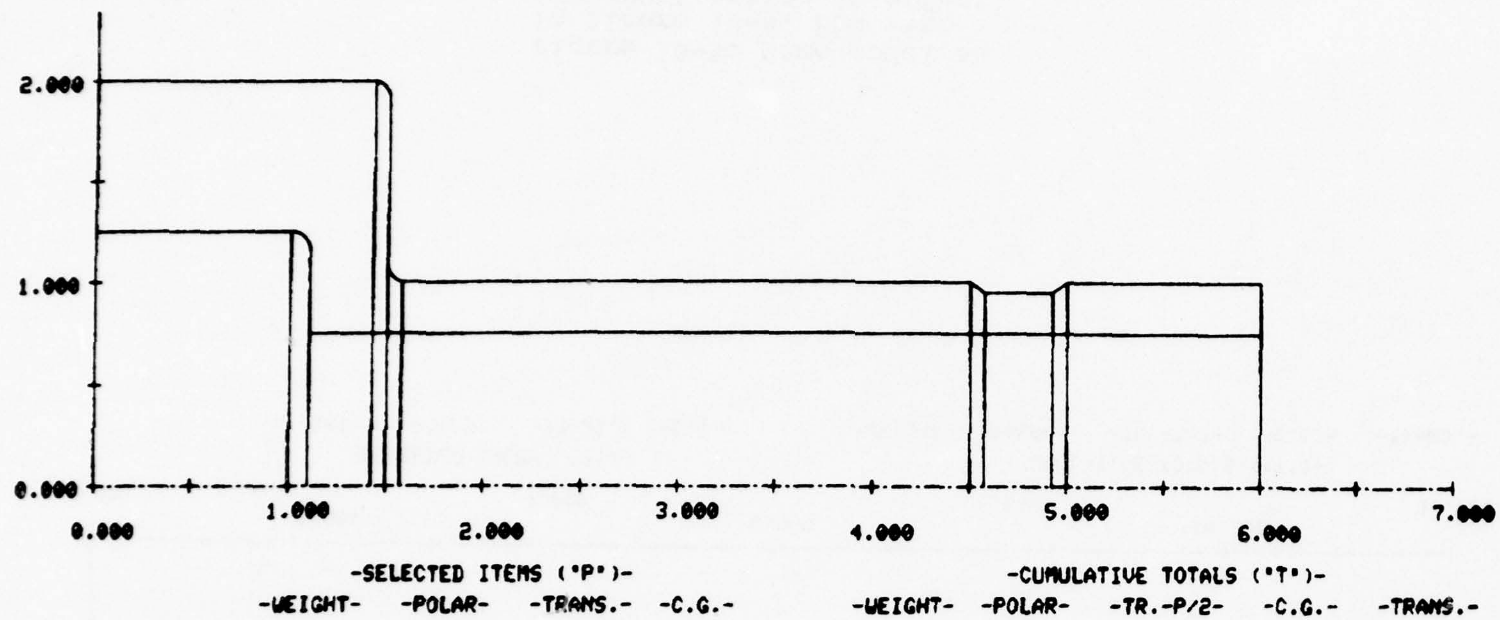


Figure 10-8. Sample shell with default VIEW=HALF option selected.

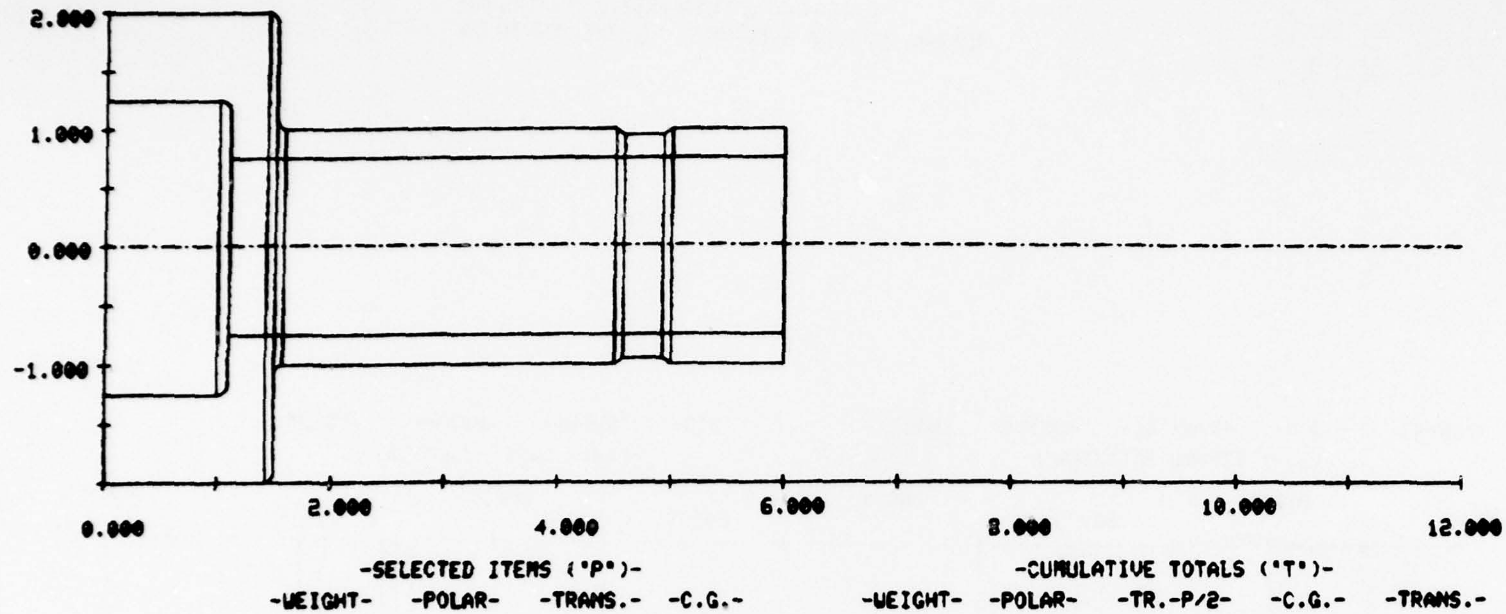


Figure 10-9. Same model as in figure 10-8, but with VIEW=FULL option in effect.

10.9 DECK OPTION

Purpose: To translate a deck to or from a non-PHASOR format:

Format: DECK=PHASOR
or
DECK=WEIGHT
or
DECK=PROMS

where the first form selects no translation, the second form selects translation to/from a "WEIGHT" program deck, and the third form selects translation to/from a "PROMS" deck. (see reference 2 and 3).

If this option is specified on a READ DIRECTIVE, the specified logical file (lfn) is translated non-destructively by PHASOR to PHASOR format.

If this option is specified on a SAVE DIRECTIVE, the specified logical file is produced by translating the EDIT file to the desired format.

Default value: DECK=PHASOR

Discussion: This option is provided as a convenience. It enables users with existing data decks for the WEIGHT program or the PROMS program to run their decks without modification on PHASOR. Further, if it is desired to run a PHASOR data deck on one of these programs, the DECK option can be used to create a data deck compatible with these programs.

Note: When saving a deck in a non-PHASOR format, PHASOR format ogives are automatically converted to WEIGHT or PROMS format ogives. Any other data card types peculiar to PHASOR such as "W" "C" and "L" are ignored.

Example:

User has an old data deck for WEIGHT analysis on a permanent file. He wishes to analyze the data on the deck using PHASOR. The following dialog is used to instruct PHASOR to use this deck.

```
//ATTACH,WDATA,WEIGHTDECK,CY=1,ID=BARETTA
//READ,WDATA,DECK=WEIGHT
PHASOR READING DATA SET   1 OF WEIGHT DECK ON WDATA
END-OF-FILE WDATA AFTER 78 CARD IMAGES.
PHASOR TRANSLATING DECK TO PHASOR FORMAT...
80 CARD IMAGES READ.
//
```

The EDIT file now contains the equivalent PHASOR format deck. Notice that the number of card images read after translation is not necessarily the same as the number of card images on the WEIGHT format file, since PHASOR had to insert certain data key cards and remove the item count card from the original deck.

10.10 SET OPTION

Purpose: To select a particular data set from a file containing more than one data set.

Format: SET=n

where n is a positive integer representing the number of the data set to be selected.

Default value: SET=1

Discussion: More than one data set may reside on a single local or permanent file. Data sets may be delimited by an "END" card in column 1-3, or in the case of PROMS decks, by an "ENDDATASET" card in columns 1 through 10. To read the first data set, specify "SET=1".

Example: User has cataloged a file containing data bases for three shells, as follows:

```
T   XM650E1  MOD 1 DATA
        ....
        ....   data cards are needed for first shell
        ....
END
T   XM 50E    MOD 2 DATA
        ....
        ....    data cards for second shell
        ....
END
T   XM650E1   MOD 6 DATA
        ....
        ....
        ....
7/8/9 card
```

Assuming user has this data file available on local file XM650, to read the MOD 2 DATA (the second data set) into the EDIT file, user could enter,

```
//READ,XM650,SET=2.
PHASOR READS DATA SET  2 OF FILE XM650
103 CARD IMAGES READ.
//
```

10.11 OFFSET OPTION

Purpose: To add a constant value to all reference dimensions in a data base.

Format: OFFSET=value

where value is any positive of negative number.

Default value: OFFSET=0.

Discussion: Occasionally it is necessary to join together two or more pieces of a shell, each of which has been separately defined. This option can be used on a READ directive to "move" one of the pieces so it will mate properly with the other parts. Otherwise it would be necessary to manually adjust all the references on the piece, or else use its total properties as a known item with the C.G. adjusted.

Example: User has a warhead and motor body, each of which has been previously analyzed and resides on its own data file. Both warhead and motor body were originally defined as starting at reference 0. Now user wishes to combine the motor and the warhead. However, user knows that the motor body should start at reference 20.6 relative to the start of the warhead. To accomplish this transformation, user combines the two data files into one edit file as follows:

```
//READ, WARHEAD
PHASOR READS DATA SET 1 OF FILE WARHEAD
66 CARD IMAGES READ.
//READ, MOTOR,OFFSET=20.6
PHASOR READS DATA SET 1 OF FILE MOTOR
47 CARD IMAGES READ.
//
```

Now the EDIT file will consist of 113 card images, and all parts of the motor body will have their reference dimensions biased by 20.6 so that when the shell is drawn, the motor body will appear in the correct position at the right end of the warhead, instead of superimposed over its left end.

10.12 START OPTION

Purpose: To specify which printer-page of output is to be displayed first during PREVIEW operation.

Format: START=n

where n is any positive integer, indicating the desired printer page number.

Default value: START=1.

Note: If the START option is specified on an EDIT DIRECTIVE, it is interpreted as a FIRST OPTION.

Example: After performing some analysis, user wishes to preview the printed output from PHASOR. However, he only wishes to see the last page of printout. He, therefore, types,

//PREVIEW,START=1000

Since user specified START=1000, PHASOR will display the last page, since there are fewer than 1000 pages of printout actually generated.

10.13 TEASE OPTION

Purpose: To specify the number of lines to be displayed at the top of each printer-page as a "tease", during PREVIEW mode.

Format: TEASE=n

where n is an integer between 1 and 52, indicating the desired number of lines.

Default value: TEASE=7.

Example: To display a 10 line tease at the top of each new printer-page display instead of a 7 line tease, user enters,

//PREVIEW,TEASE=10

10.14 YOVERX OPTION

Purpose: To specify the aspect ratio of the display.

Format: YOVERX=v

where v is any number representing the desired ratio of Y (radial) units to X (longitudinal) units.

Default value: YOVERX=1.000

Discussion: PHASOR draws the cross-section view of the shell so that the X and Y axis are approximately in the same scale as they appear on the screen. However, due to the nature of the hardware of the 4014 terminal, when a hardcopy is made on the 4631 hardcopy unit, the X and Y scales will become somewhat distorted. If you were to measure 10 units on the X axis on the hardcopy, for instance, you would find that it is not the same length as 10 units on the Y axis. Unfortunately, the variation is different with each unit and is a function of the service adjustments on the terminal. Therefore, it is impossible for PHASOR to be able to automatically make "true" hardcopies. However, if it is desired to have a hardcopy with true aspect ratio for inclusion in a report the following procedure can be used to approximate a true 1:1 relation between horizontal and vertical:

(1) Enter DRAW mode without anything in the EDIT file. PHASOR will draw the X axis 20 units long.

(2) Make a hardcopy. Using a scale, carefully measure the length from X=0 to X=6 and record this value (it will be roughly 2.4 inches).

(3) Now measure the distance from Y=0 to Y=6 units, and record it.

(4) Compute the ratio of values obtained from steps (2) and (3) above. This is the value to specify for the YOVERX on the new DRAW DIRECTIVE.

Example: In order to obtain a "true" hardcopy, user follows the above procedure. User finds the X distance for six units to be 2.42 inches, and the Y distance to be 2.49 inches. The corrected YOVERX value is therefore 0.972. User therefore creates his display for permanent retention by typing,

//DRAW,YOVERX=0.972

10.15 XSNAP OPTION

Purpose: To specify the "snap" in the X direction.

Format: XSNAP=v

where v is the desired "snap value".

Default: XSNAP=0.

Discussion: The SNAP setting applies to DRAW and TABLET mode. SNAP is the property of selective roundoff of input values. It is a natural consequence of the hardware that values entered via the cursor during DRAW mode or via the pen during TABLET mode are not "neat" numbers. For instance, if you tried to input the coordinate at (2,4) with the pen, it might actually be entered as (1.998553544,4.02222222). To help alleviate this problem, PHASOR has the ability to "snap" these input values to the nearest "neat" number. The amount of "snap" is user-selectable. A "snap" value of .5 means that PHASOR should roundoff each input value to the nearest 0.5 units. The table below will help clarify the meaning of "snap" with a few examples.....

If the X value from the tablet is...	And XSNAP is	Then the X Value is....
2.07070707	0.1	2.100000000
2.07070707	0.05	2.050000000
2.07070707	0.02	2.080000000
2.07070707	0.01	2.070000000
2.07070707	0.0	2.070707070
2.07070707	1.0	2.000000000
2.07070707	2.0	2.000000000
2.07070707	4.0	4.000000000

Example: User wishes to digitize a shell from the tablet. User wants all input dimensions from the tablet to be rounded off to the nearest .01 inch. He therefore enters,

//TABLET,XSNAP=.01,YSNAP=.01

10.16 YSNAP OPTION

Purpose: To specify the "snap" in the Y direction.

Format: YSNAP=v

where v is the desired amount of snap.

Default value: YNSAP=0.0

The discussion under section 10.15 applies to YSNAP.

10.17 YMIN OPTION

Purpose: To specify the minimum Y coordinate to be displayed or plotted, and to control the type of display generated.

Format: YMIN=v

where v is a number representing the minimum Y value desired:

Default value: YMIN=0.0

Discussion: The YMIN option may be used to "zoom" in on a particular area of the shell when used in conjunction with the "XMIN" and "XMAX" options. For all values of YMIN which are positive, the YMIN option functions in an equivalent fashion to XMIN, but for the Y axis. However, specifying a YMIN as a negative value will result in a display where the numerical value of YMIN is ignored, but the VIEW=FULL option is automatically selected. Specifying YMIN=0 will result in the VIEW=HALF option being selected automatically. See the VIEW option, section 10.8 for details.

Note that there is no such thing as a "YMAX" option.

10.18 XTIC OPTION

Purpose: To specify the logical distance between X axis tic marks.

Format: XTIC=v or XTIC=OFF or XTIC=?

where v is any positive value representing the desired tic interval on the X axis.

Default: Selected by an algorithm such that neat tic marks will exist and there will be between 12 and 30 tic marks on the axis.

Discussion: Normally the tic marks are drawn by PHASOR so that they will automatically give a display that is neat in appearance with adequate tic marks. However, user may override the default tic-mark-generation mechanism, and explicitly define the logical distance between tic marks.

Example: User wishes to have tic marks every 0.1 units along the X axis. He enters,

//DRAW,XTIC=.1

Note: Specifying XTIC=0 or XTIC=OFF will result in no tic marks at all being displayed. Specifying XTIC=? will cause PHASOR to resume its automatic procedure for specifying tic marks.

10.19 YTIC OPTION

Purpose: To specify the logical distance between Y axis tic marks.

Format: YTIC=v or YTIC=OFF or YTIC=?

Where v is any positive number representing the desired tic interval on the Y axis.

Default value: Selected by an algorithm such that tic marks appear at "neat" intervals, and that this tic interval is the same as on the X axis.

Discussion: Normally PHASOR creates the Y axis with the same distance between tic marks as the X axis. However, user can override this procedure using the YTIC option.

Example: User wishes to have tic marks every .25 inches on the X axis and every .1 inch on the Y axis. He, therefore enters:

//DRAW,XTIC=.25,YTIC=.1

10.20 XTLI OPTION

Purpose: To specify the tic label interval for the X axis.

Format: XTLI=n or XTLI=? or XTLI=OFF

where n is any positive integer, indicating the desired interval in terms of the marks.

Default: XTLI=2.

Discussion: Normally PHASOR produces a numeric tic-label on every-other tic mark. However, this procedure may be overridden by the XTLI option. The tic interval should be specified in terms of the number of tic marks to draw between tic marks. XTLI=1 means label every tic mark: XTLI=3 means label every third tic mark, etc. Specifying XTLI=? means PHASOR should return to its usual method. Specifying XTLI=0 or XTLI=OFF means no tic labels at all should be displayed.

Example: User wishes to have axis tic marks every 10 units, but with every tic mark having a numeric label. User enters:

//DRAW,XTIC=10., XTLI=1

10.21 YTLI OPTIONS

PURPOSE: To specify the tic label interval for the Y axis.

Format: YTLI=n or YTLI=OFF or YTLI=?

Default value: YTLI=2

Discussion: The discussion of section 10.20 also applies to YTLI, except that the Y axis will be effected.

11. AUTOMATIC OUTER VOLUME ALGORITHM

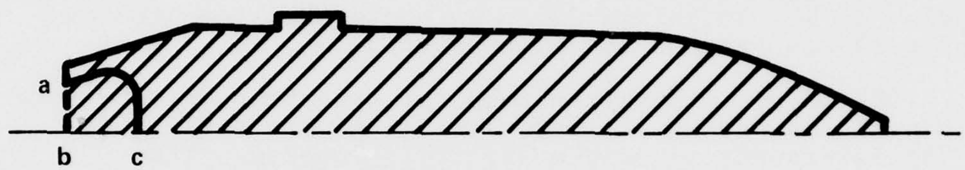
The outer volume of a shell is often needed for certain ballistic computations. In the past, using the WEIGHT program or PROMS program, the user obtained the outer volume of the shell being analyzed by designating which pieces of the shell comprised the outer volume. Designation was made by typing a "1" in column 72 to indicate that the item on the card was part of the outer surface.

PHASOR eliminates the need for this procedure by automatically computing the outer volume of the shell. If a "1" is present in column 72, it is ignored. This feature reduces the likelihood of error in outer volume calculations considerably, especially in configurations which are being changed frequently. However, there are several restrictions which must be carefully observed in order to avoid errors. Failure to observe these rules will result in erroneous outer volume computations without warning error messages. Refer to figure 11-1 in conjunction with the following rules.

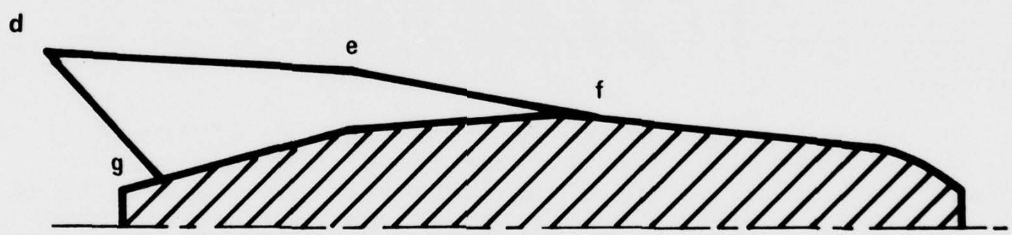
1. "Open" ends, such as the "hollow" boattail of figure 11-1a, are not subtracted by PHASOR. The outer volume is the rotated projection of the outer surface on the X axis. If it is desired to eliminate the "open" end volume from the computation this volume must be subtracted from the total volume manually. The shaded area of figure 11-1a indicates the outer volume PHASOR will compute.

2. Fins are never included in outer volume computations, whether they are part of the outer volume or not. This is because it is too difficult to implement a generalized algorithm capable of determining the volume of a fin which lies outside of the outermost body item. Although the author has developed such an algorithm, the present computer memory allocated for interactive programs is insufficient to implement it. However, it should be noted that this is not a shortcoming of PHASOR when compared with the WEIGHT program or PROMS, since neither of these programs will produce the correct result if a fin is declared to be an outer item. Thus fins should never be included in the PROMS or WEIGHT volume computation either. If it is desired to include fins in the outer volume, the computation must be made manually. For a more detailed discussion of the reasons for this limitation in all three programs, refer to Appendix D. Figure 11-1 illustrates this limitation.

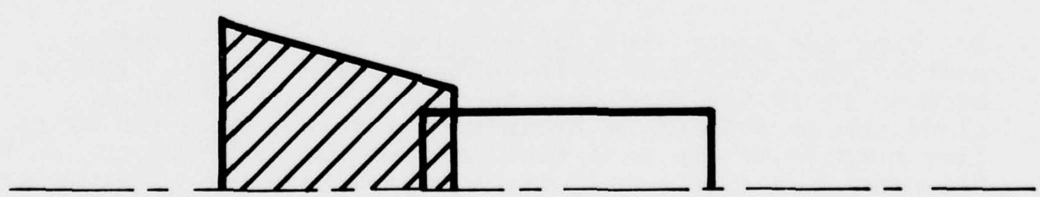
RESTRICTIONS ON AUTOMATIC OUTER VOLUME COMPUTATIONS



(1) "OPEN" ENDS ARE NOT SUBTRACTED FROM OUTER VOLUME



(2) FINS ARE NOT ADDED TO OUTER VOLUME



(3) ANY OVERLAP OF OUTER ELEMENTS IN THE X DIRECTION WILL CAUSE ERRONEOUS RESULTS

Figure 11-1. Restrictions on use of automatic outer volume algorithm.

3. Any "overlap" in the X direction of outside items will cause erroneous results. This condition is illustrated graphically at the bottom of figure 11-1. Here, the right hand body item will not be included at all in the outer volume computation, even though part of it does truly comprise the outer volume. This is so because an item must be entirely an outside item to be counted by PHASOR. There is no provision for computing the outer volume of a part of an item. Users using the TABLET mode to enter points should be especially careful in outer volume computations, since it is extremely easy to produce slight overlapping of items due to the natural impossibility of making end points of items match up exactly when using the pen. The same caution should be exercised when entering coordinates from DRAW mode using the cursor. It is important to realize that even a small overlap may cause large errors in the outer volume computation.

A more insidious example of overlap error is illustrated in figure 11-2. Figure 11-2 shows the item to be modelled, which is solid cylinder with the ends turned down to a smaller diameter. In figure 11-2b, user constructed a deck which will give correct weight and moment for the item, but will give the wrong outer volume. This is because user took a shortcut. He modelled his shell by making three items: B1, which is the inside cylinder, 6 inches long; B2, which is the outside cylinder, 3 inches long; and B2-B1, the 3 inch long area of duplication of the items, which he subtracted away. Though this method gives the correct weight, it is a violation of the overlap rule since only a portion of item B1 is included in the outer volume. The correct method for modelling the item is shown in figure 11-2c.

A flowchart describing the automatic outer volume algorithm is given in Appendix F.

User can verify the correctness of the outer volume computation easily by inspecting the OUTPUT file, where PHASOR will list all items which it determined comprised the outer volume. "Page 7" of the OUTPUT file of figure 13-1 illustrates this feature.

SAMPLE OVERLAP ERROR FOR OUTER VOLUME COMPUTATIONS

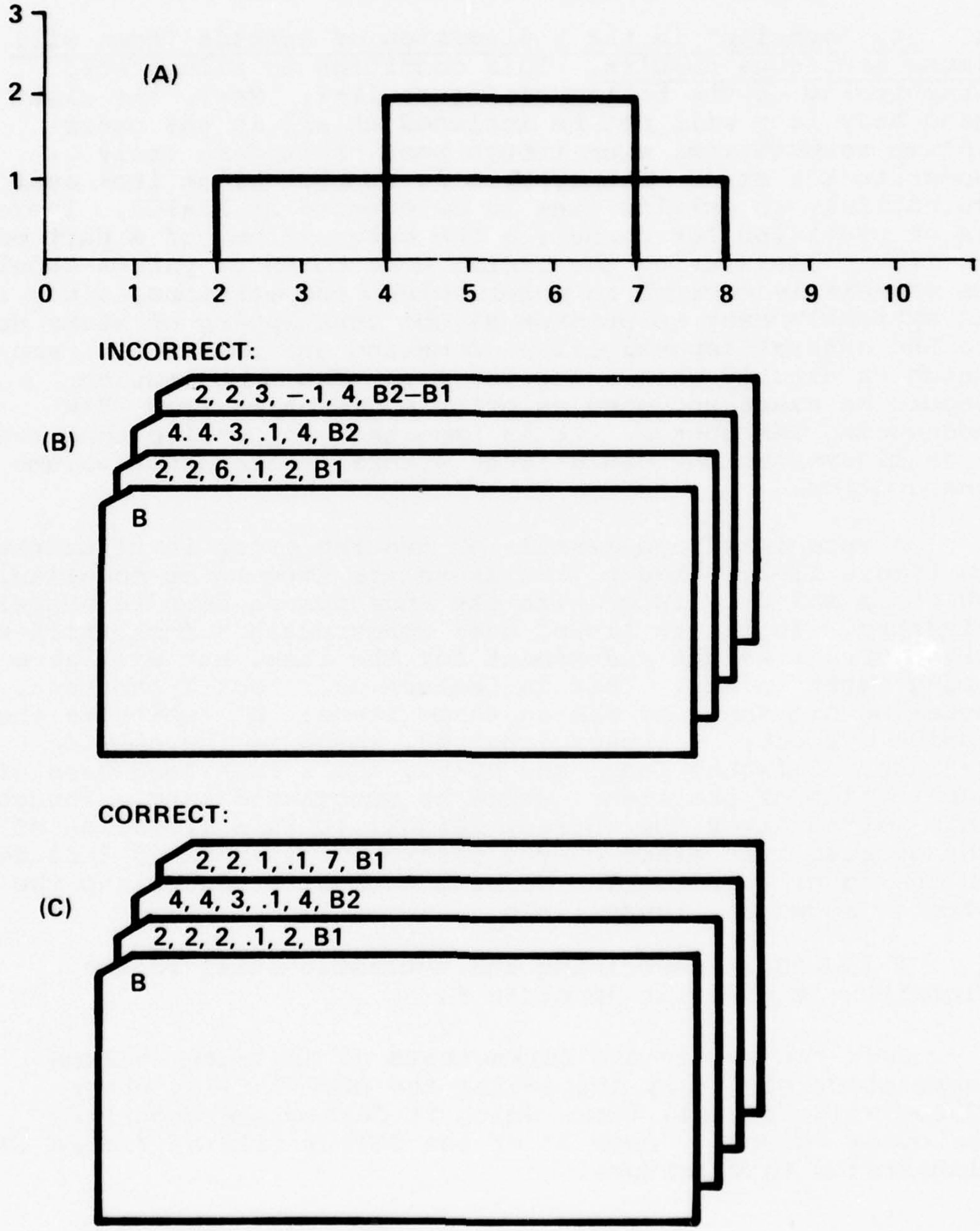


Figure 11-2. If outer volume computation is required, care must be exercised to obey rules of figure 11-1.

12. RECOVERY FROM FATAL ERRORS

A great deal of effort has been expended in the design of PHASOR so as to make it "bulletproof"; that is, it is intended that the program will be able to proceed normally no matter what errors the user makes, and furthermore, that a reasonable error message should be generated for each error. Users should find PHASOR much more forgiving and tolerant of syntactical and logic errors than most application programs.

The author recognizes that there is nothing more frustrating than to have a program "bomb out" with all data lost after an hour or two of interactive work. Unfortunately, in any program as complete as PHASOR, with its multitude of options and logic parts, there are inevitably undiscovered "bugs" lurking in the code, just waiting for the unsuspecting user to perform the right combination of operations and/or errors which will trigger the "bug" into action.

Normally when this occurs, the program "bombs out" with a fatal error message, such as "ERROR,MODE=1, ADDRESS = 56740". Should this type of error occur during PHASOR operation, however, PHASOR will override the normally-fatal system error and attempt to "die" in a manner that is non-destructive to user's data. Specifically, upon detection of a fatal system error, PHASOR will attempt to copy the present contents of the EDIT file to a local file called "SOS". PHASOR then allows itself to "bomb out" by returning control to the system.

Figure 12-1 shows a sample "bomb" and figure 12-2 shows the method used for non-destructive recovery. In figure 12-1, user is in DIRECTIVE mode, and has just requested an analysis of his shell by typing in a HARDCOPY directive, when...WHAM!!.. he hits a CP TIME LIMIT error, which is normally a fatal error (which means the EDIT file would be lost). However, PHASOR overrides the system recovery to COMMAND mode until it saves the 131 cards on the SOS file, as shown. Control is then returned to the system, which displays "COMMAND".

If the user wishes, he may now recover to where he left off before the error by following the procedure of figure 12-2. After extending his time limit, user restarts PHASOR and types in the directive,

//READ,SOS

Since the SOS file contains the EDIT file at the time of the fatal error, user has effectively recovered to his status just prior to the fatal error, and he may now repeat his HARDCOPY directive.

PHASOR may not always be able to successfully write file SOS, in which case recovery is impossible. This condition is indicated by the absence of the message, "n CARDS TO FILE SOS", where n is the number of cards in the EDIT file.

```
//ATTACH,D2,PHASORDATA,CY=2,ID=CARBREY
//READ,D2
PHASOR READS DATA SET   1 OF FILE D2
 131 CARD IMAGES READ.
//HARDCOPY

CP TIME LIMIT
 PHASOR OVERRIDES NORMALLY FATAL ERROR.
 TRYING TO SAVE CURRENT EDIT FILE
 ON FILE SOS.
  131CARDS TO SOS.
 PHASOR RETURNING CONTROL TO SYSTEM.
COMMAND- ETL,100

COMMAND- BEGIN,PHASOR,BR/CARBREY
```

Figure 12-1. PHASOR overrides a normally fatal error long enough to save user's EDIT file.

```
//READ SOS
PHASOR READS DATA SET   1 OF FILE SOS
 131 CARD IMAGES READ.
//HARDCOPY
//
```

Figure 12-2. User recovers "in tact" from the fatal error of figure 12-1.

13. PRINTED HARDCOPY

As was discussed briefly in section 5.8, 9.18, and 9.19, PHASOR automatically writes a brief chronology of events which happen during execution on a file called OUTPUT. If a HARDCOPY directive or H DRAW-mode GINK is entered, PHASOR will write a comprehensive analysis to OUTPUT. As was discussed in section 8, this OUTPUT file may be previewed at the terminal if desired. More often, however, this file is sent to a line printer either at a UT-200 remote batch terminal or at the central site in building 351. This gives the user a permanent record for retention.

The OUTPUT file will not be printed automatically at any line printer. In order to print the OUTPUT file, user must send the OUTPUT file to the desired line printer as follows:

SEND,C
for output diverted to the central site, or

SEND,xx
for output to a remote terminal, where xx is the two-character ID of the terminal. Alternatively, the INTERCOM ROUTE command may be used once PHASOR is stopped.

Example: User has just finished his analysis using PHASOR and is in DIRECTIVE mode. He wishes to obtain printed output at his UT-200 terminal in his building, which has an ID of "AC" on the CDC 6600. The correct dialog follows:

```
//STOP
     STOP PHASOR - NORMAL TERMINATION
     6.234 CP SECONDS EXECUTION TIME

COMMAND-ROUTE,OUTPUT,DC=PR,TID=AC,ST=66B
COMMAND-
```

A sample output listing is shown in figure 13- with explanatory notes added for clarity. An examination of this sample will make interpretation of your output easier.

```
           MAR 17, 1978      MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE  1

                                         PHASOR BEGUN AT  12.55.38.
PHASOR 1.0 REV. D

***** //ATTACH,MOD3,PHASORDATA,CY=3,ID=CARBREY

PHASOR ATTACHED FILE MOD3    TO CYCLE   3 OF PHASORDATA

***** //READ,MOD3

PHASOR READS DATA SET   1 OF FILE MOD3

T          81 MM BROM FROM PROMS DECK
W          -2         8          4.5        81 MM PROJECTILE
B
1.0925     1.0925     5.6450     .1000      .5000      FIN1
1.0925     1.1925     .0500      .1000      6.1450     FIN2
1.3138     1.6842     1.1331     .1000      6.2369     FIN4
.7126      .7126      .6500      -.1000     .5000      -FIN5
.7126      .6850      .1000      -.1000     1.1500     -FIN6
.6850      .6850      4.8750     -.1000     1.2500     -FIN7
.3464      0.0000     .1000      -.1000     6.2100     -FIN9
1.0715     1.0920     .0950      -.1000     6.5450     -FIN11
1.0920     1.0920     .5550      -.1000     6.6400     -FIN12
1.1550     1.1550     .1150      -.1000     7.1950     -FIN13
1.1550     1.2750     .0600      -.1000     7.3100     -FIN14
.9751      1.0851     .0550      .1000      6.6450     ADAP1
1.0851     1.0851     .5350      .1000      6.7000     ADAP2
1.0851     1.1206     .1000      .1000      7.2350     ADAP3
1.1206     1.1906     .0350      .1000      7.3350     ADAP4
1.4552     1.4552     .2500      .1000      7.3700     ADAP5
1.7079     2.7936     3.5102     .2830      7.3700     BODY1
3.1695     3.1695     .1173      .2830      12.5660    BODY3
3.1695     2.9280     .0697      .2830      12.6833    BODY4
2.9280     2.9280     .1870      .2830      12.7530    BODY5
3.1695     3.1695     1.6185     .2830      12.9400    BODY6
2.7910     2.7910     .1265      .2830      14.5585    BODY7
2.8299     2.8299     .5400      .2830      14.6850    BODY8
2.8299     2.7608     .0950      .2830      15.2250    BODY9
1.4628     1.4628     .3500      -.2830     7.3700     -BODY10
1.4628     1.3000     .1410      -.2830     7.7200     -BODY11
1.3000     1.3000     1.7220     -.2830     7.8610     -BODY12
.8250      .8250      .0510      -.2830     9.5830     -BODY13
1.9900     2.6815     2.2400     -.2830     9.6340     -BODY14
2.6815     2.6815     3.4460     -.2830     11.8740    -BODY15
1.2500     1.2500     1.9630     .0830      7.6200     FUZE
.8000      .8000      .5740      .0660      9.5830     BOOSTER
.4350      2.6815     2.7730     .3220      12.2516    LINER2
2.6815     2.6815     .2954      .3220      15.0246    LINER3
2.7600     2.7600     .0390      .3220      15.3200    LINER4
.3627      2.6035     2.7663     -.3220     12.2662    -LINER6
2.6035     2.6035     .3265      -.3220     15.0325    -LINER7
1.9900     2.6815     2.2400     .0652      9.6340     OCTOL1
2.6815     2.6815     3.1506     .0652      11.8740    OCTOL2
```

Figure 13-1. Sample PHASOR OUTPUT file, as listed on a line printer.

```
MAR 17, 1978      MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE 2

.8250     .8250     .5430     -.0652    9.6340    -OCTOL3
.4350     2.6815    2.7730    -.0652    12.2516   -OCTOL5
1.1100    1.1100    .1000     .2830     18.9750   OGIVE2
1.1428    1.1428    .3200     .2830     19.0850   OGIVE3
2.8380    2.8380    .6665     -.2830    14.5585   -OGIVE4
2.8750    2.8750    .1340     -.2830    15.2250   -OGIVE5
.2500     .2500     .1000     -.2830    18.7750   -OGIVE7
.5000     .5000     .3500     -.2830    18.8750   -OGIVE8
.9200     .9200     .1700     -.2830    19.2250   -OGIVE9
1.1502    1.1502    .4000     -.0700    18.9750   -NOSE2
1.1875    1.1875    .0500     -.0700    19.3750   -NOSE3
.4900     .4900     .3500     .0700     18.8750   NOSE4
.9000     .9000     .1700     .0700     19.2250   NOSE5
F         6
1.37      1.435     .0575     .1        0.        .1        FIN BL1
1.435     1.5675    .275      .1        .0575     .1        FIN BL2
1.5675    1.5925    .2750     .1        .3325     .1        FIN BL3
1.5925    1.5925    .3850     .1        .6075     .1        FIN BL4
1.5925    1.54      .25       .1        .9925     .1        FIN BL5
1.54      1.54      .37       .1        1.2425    .1        FIN BL6
1.54      1.4950    .19       .1        1.6125    .1        FIN BL7
1.495     1.375     .1350     .1        1.8025    .1        FIN BL8
1.375     .6875     .48       .1        1.9375    .1        FIN BL9
.7187     .7187     .5        -.1       0.        .1        -FIN BL10
.59       .59       1.9175    -.1       .5        .1        -FIN BL11
.59       .59       1.9175    .1        .5        .19       FIN BL12
.5462     .5462     1.9175    -.1       .5        .19       -FIN BL13
.5462     .5462     .0904     -.100     2.7548    .0904     -FIN HOL1
.3425     .3425     .0904     .10       2.7548    .0904     FIN HOL1
.5462     .5462     .0904     -.100     3.3548    .0904     -FIN HOL2
.3425     .3425     .0904     .1        3.3548    .0904     FIN HOL2
.5462     .5462     .0904     -.1000    3.9548    .0904     -FIN HOL3
.3425     .3425     .0904     .1        3.9548    .0904     FIN HOL 3
.5462     .5462     .0904     -.1       4.5548    .0904     -FIN HOL4
.3425     .3425     .0904     .1        4.5548    .0904     FIN HOL 4
.5462     .5462     .0904     -.1       5.1548    .0904     -FIN HOL 5
.3425     .3425     .0904     .1        5.1548    .0904     FIN HOL 5
.5462     .5462     .0904     -.1       5.7548    .0904     -FIN HOL 6
.3425     .3425     .0904     .1        5.7548    .0904     FIN HOL 6
0
-.05      -.6075    .0419     .1        6.1950    .0500     FIN3
0.        -.2575    .0850     -.1       6.125     .0850     - FIN 8
-.04      -.4957    .04       -.1       6.5050    .04       -FIN10
-3.0568   18.3682   1.6858    .283      10.8802   20.       BODY2
-.2347    0.        .1466     .3220     12.1050   .2347     LINER1
-.1957    0.        .1222     -.3220    12.144    .1957     -LINER5
-.2347    0.        .1466     -.0652    12.1050   .2347     -OCTOL4
0.        11.4153   4.4165    .283      14.5585   13.       OGIVE 1
.8005     11.4153   3.4160    -.283     15.3590   12.7115   -OGIVE 6
4.4165    11.4153   1.8       .07       18.9750   13.       NOSE1

END-OF-FILE MOD3    AFTER  92 CARD IMAGES.

***** //EDIT,FIRST=18,PAGE=10
```

Figure 13-1, continued. Sample PHASOR OUTPUT FILE, as listed on a line printer.

```
          MAR 17, 1978      MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE  3

    5 MODIFICATIONS WERE MADE TO EDIT FILE DURING EDIT MODE.

***** //DRAW,XMIN=12,XMAX=15,YMIN=1,XSNAP=.01,YSNAP=.01

    4 MODIFICATIONS WERE MADE TO EDIT FILE DURING DRAW MODE.

***** //SAVE,MOD4

PHASOR SAVED  94 CARD IMAGES ON FILE MOD4

***** //CATALOG,MOD4,NEW81MOD4,ID=CARBREY,CY=1

PHASOR CATALOGED MOD4    UNDER ID=   CARBREY, CY=  1, PF=NEW81MOD4

***** //PUBCH

///ERROR. UNRECOGNIZABLE DIRECTIVE.

***** //PUNCH

PHASOR WILL PUNCH  94 CARDS.

PUNCHED DECK WILL BE NAMED DHDHI5W

***** //HARDCOPY
```

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

MAR 17, 1978 MISD/SEAD REV. D ***** PHASOR 1.0 ***** PICATINNY ARSENAL PAGE 4

81 MM BROM FROM PROMS DECK

CARD TYPE DESCRIPTIVE FIELDS

1 TITLE 81 MM BROM FROM PROMS DECK

2 WRITE W SZ= -2.0000 X = 8.0000 Y= 4.5000 81 MM PROJECTILE

CARD	TYPE	D1=	D2=	H=	RHO=	REF=	ID=
4	BODY	1.0925	1.0925	5.6450	.1000	.5000	FIN1
5	BODY	1.0925	1.1925	.0500	.1000	6.1450	FIN2
6	BODY	1.3138	1.6842	1.1331	.1000	6.2369	FIN4
7	BODY	.7126	.7126	.6500	-.1000	.5000	-FIN5
8	BODY	.7126	.6850	.1000	-.1000	1.1500	-FIN6
9	BODY	.6850	.6850	4.8750	-.1000	1.2500	-FIN7
10	BODY	.3464	0.0000	.1000	-.1000	6.2100	-FIN9
11	BODY	1.0715	1.0920	.0950	-.1000	6.5450	-FIN11
12	BODY	1.0920	1.0920	.5550	-.1000	6.6400	-FIN12
13	BODY	1.1550	1.1550	.1150	-.1000	7.1950	-FIN13
14	BODY	1.1550	1.2750	.0600	-.1000	7.3100	-FIN14
15	BODY	.9751	1.0851	.0550	.1000	6.6450	ADAP1
16	BODY	1.0851	1.0851	.5350	.1000	6.7000	ADAP2
17	BODY	1.0851	1.1206	.1000	.1000	7.2350	ADAP3
18	BODY	1.1206	1.1906	.0350	.1000	7.3350	ADAP4
19	BODY	1.4552	1.4552	.2500	.1000	7.3700	ADAP5
20	BODY	1.7079	2.7936	3.5102	.2830	7.3700	BODY1
21	BODY	3.1695	3.1695	.1173	.2830	12.5660	BODY3
22	BODY	2.9280	2.9280	.1870	.2220	12.7530	BODY5
23	BODY	3.1695	3.1695	1.6185	.2220	12.9400	BODY6
24	BODY	2.7910	2.7910	.1265	.2220	14.5585	BODY7
25	BODY	2.8299	2.8299	.5400	.2220	14.6850	BODY8
26	BODY	2.8299	2.7608	.0950	.2830	15.2250	BODY9
27	BODY	1.4628	1.4628	.3500	-.2830	7.3700	-BODY10
28	BODY	1.4628	1.3000	.1410	-.2830	7.7200	-BODY11
29	BODY	1.3000	1.3000	1.7220	-.2830	7.8610	-BODY12
30	BODY	.8250	.8250	.0510	-.2830	9.5830	-BODY13
31	BODY	1.9900	2.6815	2.2400	-.2830	9.6340	-BODY14
32	BODY	2.6815	2.6815	3.4460	-.2830	11.8740	-BODY15
33	BODY	1.2500	1.2500	1.9630	.0830	7.6200	FUZE
34	BODY	.8000	.8000	.5740	.0660	9.5830	BOOSTER
35	BODY	.4350	2.6815	2.7730	.3220	12.2516	LINER2
36	BODY	2.6815	2.6815	.2954	.3220	15.0246	LINER3
37	BODY	2.7600	2.7600	.0390	.3220	15.3200	LINER4
38	BODY	.3627	2.6035	2.7663	-.3220	12.2662	-LINER6
39	BODY	2.6035	2.6035	.3265	-.3220	15.0325	-LINER7
40	BODY	1.9900	2.6815	2.2400	.0652	9.6340	OCTOL1
41	BODY	2.6815	2.6815	3.1506	.0652	11.8740	OCTOL2
42	BODY	.8250	.8250	.5430	-.0652	9.6340	-OCTOL3
43	BODY	.4350	2.6815	[illegible]	[illegible]	[illegible]	[illegible]
44	BODY	1.1100	1.1100				
45	BODY	1.1428	1.1428				
46	BODY	2.8380	2.8330				
47	BODY	2.8750	2.8750				
48	BODY	.2500	.2500				
49	BODY	.5000	.5000				
50	BODY	.9200	.9200				

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

```
     MAR 17, 1978     MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE  5
                                             81 MM BROM FROM PROMS DECK

51 BODY      D1=  1.1502 D2=  1.1502  H=   .4000 RHO= -.0700 REF=  18.9750 ID=-NOSE2
52 BODY           1.1875      1.1875       .0500      -.0700       19.3750    -NOSE3
53 BODY            .4900       .4900       .3500       .0700       18.8750    NOSE4
54 BODY            .9000       .9000       .1700       .0700       19.2250    NOSE5

56 FIN* 6 R1=    1.3700  R2=  1.4350  H=   .0575 RHO=  .1000 REF=   0.0000 TH=   .1000 ID=FIN BL1
57 FIN* 6        1.4350       1.5675       .2750       .1000          .0575        .1000    FIN BL2
58 FIN* 6        1.5675       1.5925       .2750       .1000          .3325        .1000    FIN BL3
59 FIN* 6        1.5925       1.5925       .3850       .1000          .6075        .1000    FIN BL4
60 FIN* 6        1.5925       1.5400       .2500       .1000          .9925        .1000    FIN BL5
61 FIN* 6        1.5400       1.5400       .3700       .1000         1.2425        .1000    FIN BL6
62 FIN* 6        1.5400       1.4950       .1900       .1000         1.6125        .1000    FIN BL7
63 FIN* 6        1.4950       1.3750       .1350       .1000         1.8025        .1000    FIN BL8
64 FIN* 6        1.3750        .6875       .4800       .1000         1.9375        .1000    FIN BL9
65 FIN* 6         .7187        .7187       .5000      -.1000         0.0000        .1000    -FIN BL10
66 FIN* 6         .5900        .5900      1.9175      -.1000          .5000        .1000    -FIN BL11
67 FIN* 6         .5900        .5900      1.9175       .1000          .5000        .1900    FIN BL12
68 FIN* 6         .5462        .5462      1.9175      -.1000          .5000        .1900    -FIN BL13
69 FIN* 6         .5462        .5462       .0904      -.1000         2.7548        .0904    -FIN HOL1
70 FIN* 6         .3425        .3425       .0904       .1000         2.7548        .0904    FIN HOL1
71 FIN* 6         .5462        .5462       .0904      -.1000         3.3548        .0904    -FIN HOL2
72 FIN* 6         .3425        .3425       .0904       .1000         3.3548        .0904    FIN HOL2
73 FIN* 6         .5462        .5462       .0904      -.1000         3.9548        .0904    -FIN HOL3
74 FIN* 6         .3425        .3425       .0904       .1000         3.9548        .0904    FIN HOL 3
75 FIN* 6         .5462        .5462       .0904      -.1000         4.5548        .0904    -FIN HOL4
76 FIN* 6         .3425        .3425       .0904       .1000         4.5548        .0904    FIN HOL 4
77 FIN* 6         .5462        .5462       .0904      -.1000         5.1548        .0904    -FIN HOL 5
78 FIN* 6         .3425        .3425       .0904       .1000         5.1548        .0904    FIN HOL 5
79 FIN* 6         .5462        .5462       .0904      -.1000         5.7548        .0904    -FIN HOL 6
80 FIN* 6         .3425        .3425       .0904       .1000         5.7548        .0904    FIN HOL 6

82 OGIVE 0  A=   -.0500  B=   -.6075  H=   .0419 RHO=  .1000 REF=   6.1950 R=    .0500 ID=FIN3
83 OGIVE 0       0.0000       -.2575       .0850      -.1000         6.1250        .0850    - FIN 8
84 OGIVE 0       -.0400       -.4957       .0400      -.1000         6.5050        .0400    -FIN10
85 OGIVE 0      -3.0568      18.3682      1.6858       .2830        10.8802      20.0000    BODY2
86 OGIVE 0       -.2347       0.0000       .1466       .3220        12.1050        .2347    LINER1
87 OGIVE 0       -.1957       0.0000       .1222      -.3220        12.1440        .1957    -LINER5
88 OGIVE 0       -.2347       0.0000       .1466      -.0652        12.1050        .2347    -OCTOL4
89 OGIVE 0       0.0000      11.4153      4.4165       .2830        14.5585      13.0000    OGIVE 1
90 OGIVE 0        .8005      11.4153      3.4160      -.2830        15.3590      12.7115    -OGIVE 6
91 OGIVE 0       4.4165      11.4153      1.8000       .0700        18.9750      13.0000    NOSE1

93 BODY      D1=  3.1600 D2=  3.1800  H=   .0500 RHO=  .2220 REF=  12.6800 ID=
94 BODY           3.1800      3.0800       .0200       .2220       12.7300
```

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

81 MM BROM FROM PROMS DECK

CARD	TYPE	IDENTIFICATION	WEIGHT	POLAR	TRANSVERSE	C.G.	VOLUME
4	BODY	FIN1	.52917	.07895	1.40522	3.32250	5.29172
5	BODY	FIN2	.00513	.00084	.00000	6.17073	.05129
6	BODY	FIN4	.20099	.05788	.02116	6.84988	2.00986
7	BODY	-FIN5	-.02592	-.00165	-.00091	.82500	.25924
8	BODY	-FIN6	-.00384	-.00023	-.00000	1.19934	.03836
9	BODY	-FIN7	-.17966	-.01054	-.35581	3.68750	1.79658
10	BODY	-FIN9	-.00031	-.00000	-.00000	6.23500	.00314
11	BODY	-FIN11	-.00873	-.00128	-.00001	6.59280	.08731
12	BODY	-FIN12	-.05198	-.00775	-.00133	6.91750	.51979
13	BODY	-FIN13	-.01205	-.00201	-.00001	7.25250	.12049
14	BODY	-FIN14	-.00696	-.00129	-.00000	7.34099	.06962
15	BODY	ADAP1	.00459	.00061	.00000	6.67348	.04588
16	BODY	ADAP2	.04947	.00728	.00118	6.96750	.49475
17	BODY	ADAP3	.00955	.00145	.00001	7.28554	.09553
18	BODY	ADAP4	.00367	.00061	.00000	7.35285	.03672
19	BODY	ADAP5	.04158	.01101	.00022	7.49500	.41579
20	BODY	BODY1	4.02905	2.79568	3.89118	9.40194	14.23694
21	BODY	BODY3	.26191	.32889	.00030	12.62465	.92549
22	BODY	BODY5	.27953	.29956	.00081	12.84650	1.25914
23	BODY	BODY6	2.83490	3.55982	.61884	13.74925	12.76980
24	BODY	BODY7	.17181	.16729	.00023	14.62175	.77393
25	BODY	BODY8	.75401	.75480	.01832	14.95500	3.39645
26	BODY	BODY9	.16500	.16121	.00012	15.27211	.58305
27	BODY	-BODY10	-.16646	-.04452	-.00170	7.54500	.58820
28	BODY	-BODY11	-.05987	-.01436	-.00010	7.78773	.21157
29	BODY	-BODY12	-.64684	-.13664	-.15984	8.72200	2.28565
30	BODY	-BODY13	-.00772	-.00066	-.00000	9.60850	.02726
31	BODY	-BODY14	-2.73614	-1.93378	-1.11776	10.86372	9.66832
32	BODY	-BODY15	-5.50741	-4.95009	-5.45000	13.59700	19.46080
33	BODY	FUZE	.19994	.03905	.06420	8.60150	2.40896
34	BODY	BOOSTER	.01904	.00152	.00052	9.87000	.28852
35	BODY	LINER2	1.99776	1.08186	.78698	14.20603	6.20422
36	BODY	LINER3	.53717	.48281	.00391	15.17230	1.66823
37	BODY	LINER4	.07513	.07154	.00001	15.33950	.23333
38	BODY	-LINER6	-1.83155	-.93357	-.68996	14.23461	5.68803
39	BODY	-LINER7	-.55969	-.47421	-.00497	15.19575	1.73815
40	BODY	OCTOL1	.63037	.44552	.25752	10.86372	9.66832
41	BODY	OCTOL2	1.16008	1.04268	.95960	13.44930	17.79257
42	BODY	-OCTOL3	-.01893	-.00161	-.00047	9.90550	.29027
43	BODY	-OCTOL5	-.40452	-.21906	-.15935	14.20603	6.20422
44	BODY	OGIVE2	.02739	.00422	.00002	19.02500	.09677
45	BODY	OGIVE3	.09289	.01516	.00079	19.24500	.32823
46	BODY	-OGIVE4	-1.19317	-1.20126	-.04417	14.89175	4.21614
47	BODY	-OGIVE5	-.24618	-.25436	-.00037	15.29200	.86990
48	BODY	-OGIVE7	-.00139	-.00001	-.00000	18.82500	.00491
49	BODY	-OGIVE8	-.01945				.06872
50	BODY	-OGIVE9	-.03198				.11301
51	BODY	-NOSE2	-.02909				.41562
52	BODY	-NOSE3	-.00388				.05538
53	BODY	NOSE4	.00462				.06600
54	BODY	NOSE5	.00757				.10815
56	FIN	FIN BL1	.00484				.04839

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

MAR 17, 1978 MISD/SEAD REV. D ***** PHASOR 1.0 ***** PICATINNY ARSENAL PAGE 7

81 MM BROM FROM PROMS DECK

CARD	TYPE	IDENTIFICATION	WEIGHT	POLAR	TRANSVERSE	C.G.	VOLUME
57	FIN	FIN BL2	.02477	.01865	.00016	.19702	.24771
58	FIN	FIN BL3	.02607	.02170	.00016	.47036	.26070
59	FIN	FIN BL4	.03679	.03110	.00045	.80000	.36787
60	FIN	FIN BL5	.02349	.01922	.00012	1.11680	.23494
61	FIN	FIN BL6	.03419	.02703	.00039	1.42750	.34188
62	FIN	FIN BL7	.01730	.01328	.00005	1.70703	.17300
63	FIN	FIN BL8	.01162	.00799	.00002	1.86906	.11624
64	FIN	FIN BL9	.02970	.01170	.00055	2.15083	.29700
65	FIN	-FIN BL10	-.02156	-.00371	-.00045	.25000	.21561
66	FIN	-FIN BL11	-.06788	-.00788	-.02080	1.45875	.67880
67	FIN	FIN BL12	.12897	.01496	.03952	1.45875	1.28971
68	FIN	-FIN BL13	-.11940	-.01187	-.03658	1.45875	1.19397
69	FIN	-FIN HOL1	-.00268	-.00027	-.00000	2.80000	.02678
70	FIN	FIN HOL1	.00168	.00007	.00000	2.80000	.01679
71	FIN	-FIN HOL2	-.00268	-.00027	-.00000	3.40000	.02678
72	FIN	FIN HOL2	.00168	.00007	.00000	3.40000	.01679
73	FIN	-FIN HOL3	-.00268	-.00027	-.00000	4.00000	.02678
74	FIN	FIN HOL 3	.00168	.00007	.00000	4.00000	.01679
75	FIN	-FIN HOL4	-.00268	-.00027	-.00000	4.60000	.02678
76	FIN	FIN HOL 4	.00168	.00007	.00000	4.60000	.01679
77	FIN	-FIN HOL 5	-.00268	-.00027	-.00000	5.20000	.02678
78	FIN	FIN HOL 5	.00168	.00007	.00000	5.20000	.01679
79	FIN	-FIN HOL 6	-.00268	-.00027	-.00000	5.80000	.02678
80	FIN	FIN HOL 6	.00168	.00007	.00000	5.80000	.01679
82	OGIVE	FIN3	.00547	.00114	.00000	6.21634	.05473
83	OGIVE	- FIN 8	-.00282	-.00015	-.00000	6.16492	.02817
84	OGIVE	-FIN10	-.00349	-.00049	-.00000	6.52536	.03493
85	OGIVE	BODY2	3.38959	3.85277	.79429	11.75806	11.97734
86	OGIVE	LINER1	.00404	.00007	.00001	12.19952	.01255
87	OGIVE	-LINER5	-.00234	-.00003	-.00000	12.22279	.00727
88	OGIVE	-OCTOL4	-.00082	-.00001	-.00000	12.19952	.01255
89	OGIVE	OGIVE 1	7.15355	7.17120	9.87508	16.37023	25.27757
90	OGIVE	-OGIVE 6	-3.19560	-1.91264	-2.58697	16.70291	11.29186
91	OGIVE	NOSE1	.09623	.01971	.01249	19.45285	1.37478
93	BODY		.08761	.11004	.00002	12.70505	.39462
94	BODY		.03417	.04186	.00000	12.73989	.15390

PHASOR DETERMINED OUTER VOLUME WAS COMPRISED OF FOLLOWING EDIT FILE CARDS...

4 5 82 6 20 85 21 94 22
89 91

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

```
MAR 17, 1978     MISD/SEAD REV. D      ***** PHASOR 1.0 *****      PICATINNY ARSENAL      PAGE  8

                                  81 MM BROM FROM PROMS DECK

      TOTAL PROPERTIES FOR  53 BODY ITEMS, 25 FIN ITEMS,  0 KNOWN ITEMS, AND  10 OGIVE ITEMS...

                    WEIGHT=                       8.0272
                    POLAR INERTIA =              10.6404
                    TRANSVERSE - POLAR/2 =      134.8158
                    CENTER OF GRAVITY =          12.3014
                    TRANSVERSE INERTIA =        140.1360
                    OUTER VOLUME =               75.3825
```

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

```
***** //STOP
```

Figure 13-1, continued. Sample PHASOR OUTPUT file, as listed on a line printer.

```
PHASOR USED  8.758 C.P. SECONDS.
PHASOR STOPPED AT  13.01.28.
```

APPENDIX A

TROUBLESHOOTING GUIDE FOR LOGIN PROCEDURE.

This section is intended to help you figure out what went wrong while trying to LOGIN. "Step No." refers to the *LOGIN* procedure step number of section 2.1.

Step No.	Problem Description	Possible Cause	Probable Cure
(1)	Terminal dead	Not plugged in	Power cord to 115V outlet.
		Blown fuze	Check 2 fuzes, rear of unit. If blown see Jim O'Brien,X4912
(6)	Phone busy.	Port in use.	Choose alternate line, See Reference 4
(7)	No answer.	Misdialed.	Dial again.
		Computer down.	Dial autovon 800-6222 for recorded computer status message.
(8)	Heard tone, pushed "DATA", nothing on screen, or garbage on screen	*Baud rate wrong.*	*On rear of* terminal pedestal, set rotary switch to 300, slide switch below it to "ASCII", and start over.
		Code expander on.	Turn CODE EXPANDER rocker switch at top of keyboard to "OFF". Precede to step 9.
		Incorrect initialization.	Carefully repeat steps 2-8.
		Computer down.	See step 7 cure
	Got "PLEASE LOGIN" message O.K., Typed "LOGIN,Lxxxyyyzzz. but doesn't show up on screen.	Incorrect initialization	Repeat carefully steps 2-8.

Step No.	Problem Description	Possible Cause	Probable Cure
(8)	Typed "LOGIN", but no response from computer.	LOCAL mode	Set LOCAL/LINE to LINE
(10)	Computer displayed, "FATAL LOADER ERROR-NO SUCH PROGRAM CALL NAME", etc.	Misspelled command	Repeat step 10 carefully
(10)	Computer typed "FILE NOT IN SYSTEM".	Misspelled or incomplete "BEGIN..."	Repeat "BEGIN..." command carefully.
		File lost.	Call B. Carbrey Autovon 880-4364
(11)	Computer didn't respond as indicated to ATTACH READ, or DRAW directive.	Syntax error	Repeat directives carefully, being observant of commas.
(12)	Computer displayed "KEYSTOKE ERROR" when T entered.	TTY LOCK not depressed.	Depress TTY lock key.
		RETURN depressed	DO NOT depress carraige return after any Graphic input keystroke.

APPENDIX B

INTRODUCTION TO PERMANENT FILES

One of the areas of most confusion and least understanding among new computer users and even among many veteran programmers is the area of permanent file concepts. This section attempts to present a simple explanation of the logical organization of permanent files used on the CDC 6000 computer.

In order to clarify the file concepts, we shall draw on our knowledge of ordinary office files of the "garden" variety.

Imagine we have an office with a file cabinet for retention of permanent documents, and a pad of paper on a desk. Each day the janitor tears any used sheets of paper on the pad off and throws them away, but he never touches the file cabinet.

On the computer there are two kinds of storage devices. one is a permanent file device, which can save files indefinately, like the file cabinet. The other type is a scratch file device, which can only hold files temporarily and is cleaned out like the pad of paper at the end of a job.

Files which we use during execution of programs or control cards are assigned by the system, and may be either on the pad or in the file cabinet. If we want to insure that we will have our file in the file cabinet, we must first request a permanent file device before we write the file.

To continue our office-file analogy, suppose we have requested a permanent file device, and now we wish to write on the file. During our request, we specified a local file name (lfn). This local file name may be thought of as a temporary tag which the system places on a blank pad inside some arbitrarily chosen file folder in the file cabinet. For instance, if we have the control cards

REQUEST,AAA,*PF.

the system will take a temporary tag, label it "AAA", and stick to some empty file folder, inside the cabinet. Now if we write on file AAA, the system looks for the temporary tag, and when found, writes in that folder.

When our job is complete, the system has a file tagged "AAA" in the file cabinet. However, the file is not a full-fledged permanent file because the system takes off the temporary tag AAA and throws it away at the end of our job. Since there is no tag on the file folder, the system doesn't know where to look for it when you want it, even though it is in the file cabinet.

In order to make a complete permanent file, we must put a permanent label on the file folder so the system can find the folder by name and owner. Our control card,

CATALOG,AAA, MYFILE,ID=MYNAME.

causes the system to tag the file folder as "MYFILE" with an owner of "MYNAME". Now when the temporary tag AAA is thrown away at the end of the job, the permanent name is still on the folder and the file can be found at a later date. This illustrates a commonly believed fallacy: that the CATALOG card causes the local file to be copied into a special area for retention. Actually, the CATALOG card doesn't copy the file at all, and merely records its location in a permanent file directory which is indexed like a telephone book by user ID and permanent file name.

Cycle numbers may be thought of as partitions inside the file folder which are numbered with any numbers between 1 and 999. Up to 5 partitions may be made.

Now let us examine how a permanent file is attached. Consider the control card,

ATTACH,BBB,MYFILE,ID=MYNAME.

A common misconception is that this card causes the file MYFILE, ID=MYNAME to be copied onto another file named BBB. This is not true. All the attach card does is tell the system to search the permanent file directory for MYFILE, and when found, to put a temporary tag or LFN on the file folder so that the system can refer to it by the shorthand tag and not have to look up the permanent file in the directory each time the file is accesed.

In the light of the system described above, it is easy to see how some of the more common permanent file errors come about.

For instance, the error message,

"FILE NOT ON PF DEVICE"

means our file was assigned to scratch storage and not to the file cabinet by the system since we didn't specify it had to be on a permanent file device, and when the system tried to put the permanent tag on it for the CATALOG card, it couldn't, because the file wasn't in a folder in the cabinet.

"LFN ALREADY IN USE" means we tried to assign the same temporary tag to two files. Since the system only uses the temporary tags for identification during job processing, if both files were assigned the same tag it would be impossible to tell them apart. One way you can get this diagnostic is like this:

```
ATTACH,ABC,MYFILE,ID=MYNAME,CY=1.
PURGE,ABC.
REQUEST,ABC,*PF.
```

This will result in the error message above because the PURGE card only causes the system to remove the permanent label from the file folder. It does not erase the file or remove the temporary tag ABC. Thus we can still reference file ABC even after it has been purged, because it is still a local file. To get rid of file ABC completely, we would need to type,

```
PURGE,ABC.
RETURN,ABC.
```

This will remove all tags from the file folder.

By logical extention of the simple office-file analogy above, you may be able to avoid many of the common pitfalls of permanent file useage.

APPENDIX C

SOURCE DECK AVAILABILITY

PHASOR was developed entirely in-house at Picatinny Arsenal by Bruce Carbrey of the Managment Information Systems Directorate, Scientific & Engineering Applications Division. Copies of the source program will be distributed to interested parties after approval of a written request by Chief, Scientific & Engineering Applications Division. Due to the size of the program, source decks will be provided on magnetic tape only, without listings.

The following facts pertain to PHASOR implementation:

Source Languages: FORTRAN EXTENDED (98%), COMPASS (2%)

Source deck length: 14,700 cards (not including Tektronix or system routines)

Object program structure:

Number of main programs: 2 (PHASOR and slave program PSLAVE, which runs concurrently with, and under the control of, PHASOR)

Number of overlays: 13 (Standard CDC Segments)

Number of subroutines: 131 (not including Tektronix or system routines)

Required memory to run: 60000 octal (PHASOR), 50000 (PSLAVE)

Required memory to load: 110000 octal.

Files used: 7 (PHASOR), 5 (PSLAVE)

System dependencies: CDC 6000 series computer with SCOPE 3.4 operating system; Tektronix 4014 terminal with enhanced graphics module; ARRADCOM-modified Tektronix PLOT-10 TCS software package; ARRADCOM local modifications to SCOPE; ARRADCOM TCS utility routines.

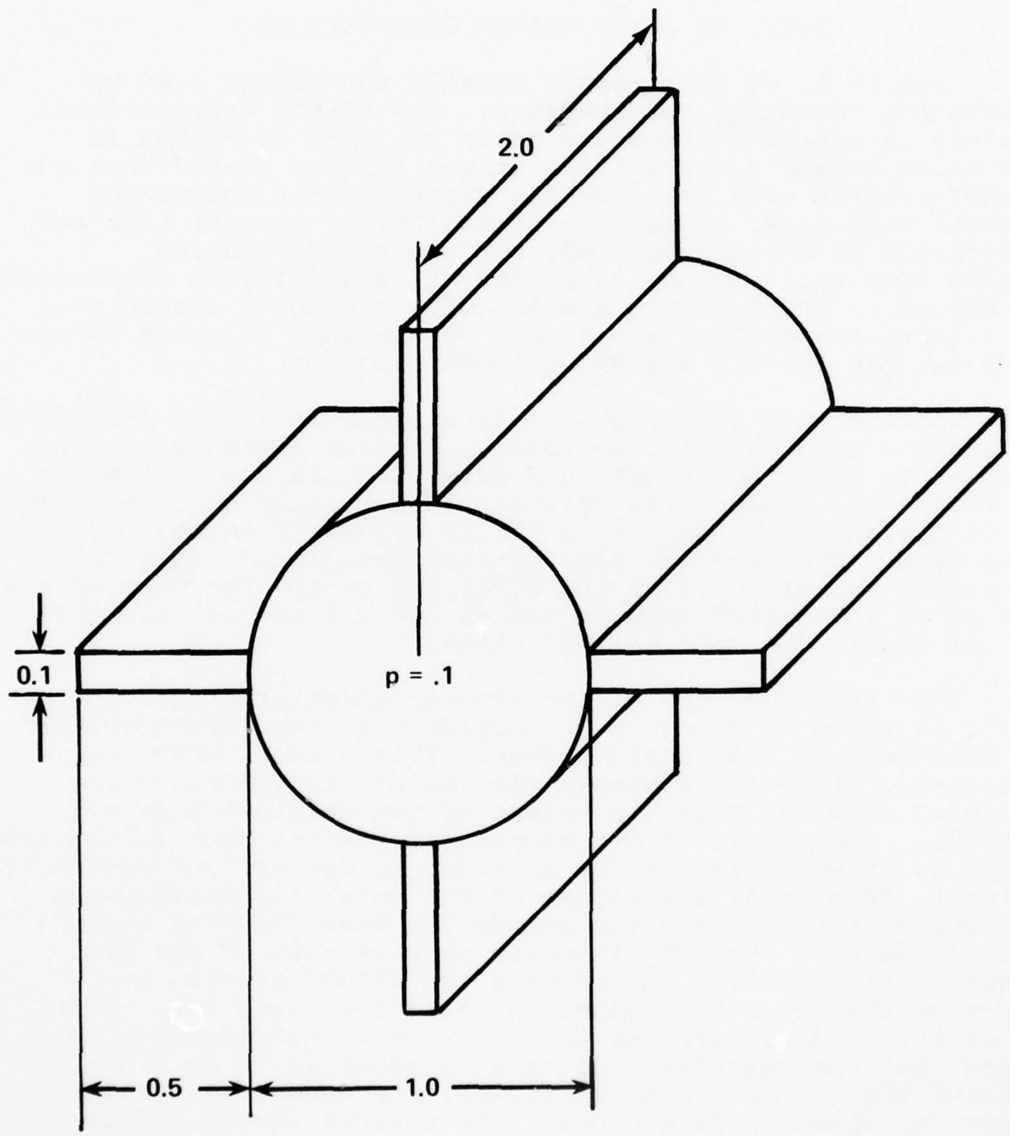
APPENDIX D

NOTES ON OUTER VOLUME COMPUTATIONS

Section 11 of this report details the method used by PHASOR for computing outer volume. One of the restrictions imposed is that fin items are never included by PHASOR in its outer volume computation. It was further stated that the WEIGHT program will not give the correct outer volume for a shell with fins, regardless of whether or not the fins are designated as an outside item, so this restriction on PHASOR does not represent any loss of capability in comparison to WEIGHT or PROMS. This section will present a simple case to illustrate why fins should not be included in outer volume computations for the WEIGHT or PROMS programs.

Consider the simple shell illustrated in figure D-1 which consists only of a solid cylinder with four rectangular fins mounted to it. The WEIGHT data deck for this shell is shown in figure D-2. Since the cylinder is certainly an outer item, it is designated as such by a "1" in column 72 on the body data card. The fins are also outside data items, so a "1" is placed in column 72 of the first fin card. The part of the fin to be subtracted away is not an outer item, so column 72 of the second fin card is left blank.

The results of the WEIGHT program computation for the shell is shown in figure D-2. Notice that the "OUTER VOLUME" is described as 2.37 cubic inches. This answer, however, is erroneous, since it is simply the sum of the volume of the cylinder (1.5708) plus the volume of the entire fin item 1 (.8000). The volume of the second fin has not been subtracted away, as it would have to be in order to get the correct outer volume. In effect, the volume of the outer fin between the surface of the body and the center has been "counted twice"; once as part of the body item and once as part of the fin. There is no provision for forcing the WEIGHT program to subtract the inner fin volume way from the outer fin. Even if we try to designate the inner fin as an outside item in hopes that the negative density will cause it to be "subtracted away" from the total volume, the answer is still wrong, as shown in figure D-3. The correct answer can be found easily by manually computing the outer volume as follows:



SAMPLE SHELL FOR ERRONEOUS OUTER VOLUME
COMPUTATION EXAMPLE USING WEIGHT PROGRAM.

Figure D-1. Fins are not properly included as "outer volume" items when using the WEIGHT program, as illustrated by this example.

SAMPLE DECK EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

WEIGHT CALCULATION REQUESTED
PLOT NOT REQUESTED
STABILITY CALCULATION NOT REQUESTED

1 BODY ITEMS

4 FINS

2 FIN PIECES

-0 KNOWN ITEMS

-0 OGIVES

1 COPIES OUTPUT REQUESTED

-0 DATA CHANGES

SAMPLE DECK EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

INPUT DATA FOR BODY OF SHELL

NO.	IDENTIFICATION	D1	D2	LENGTH	DENSITY	REFERENCE
1	CYLINDER 1	1.0000	1.0000	2.0000	.1000	0.0000

INPUT DATA FOR FINS

4-FINS

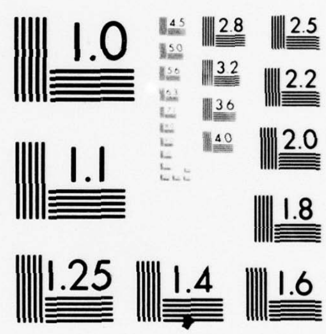
NO.	IDENTIFICATION	R1	R2	LENGTH	DENSITY	REFERENCE	THICKNESS
1	FIN 1	1.0000	1.0000	2.0000	.1000	0.0000	.1000
2	-FIN *	.5000	.5000	2.0000	-.1000	0.0000	.1000

Figure D-2. WEIGHT program output illustrating erroneous outer volume computation when fins are included, for the model of figure D-1.

AD-A057 682 ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND DOVER--ETC F/G 12/1
PHASOR PHYSICAL ANALYSIS OF SOLIDS OF REVOLUTION, USER MANUAL.(U)
APR 78 B D CARBREY
UNCLASSIFIED MISD-UM-78-4 NL

4 OF 4
AD
A057682

END
DATE
FILMED
9-78
DDC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SAMPLE DECK EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

PROPERTIES OF BODY ITEMS

NO.	IDENTIFICATION	WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	CYLINDER 1	.1571	.0196	.0524	1.0000	1.5708

PROPERTIES OF FIN ITEMS

NO.	IDENTIFICATION	WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	FIN 1	.0800	.0267	.0267	1.0000	.8000
2	-FIN *	-.0400	-.0033	-.0133	1.0000	.4000

SAMPLE DECK EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

PROPERTIES OF ENTIRE SHELL

WEIGHT= .1971 POUNDS

CG TO REF= 1.0000 INCHES

POLAR INERTIA= .0430 POUND INCH SQUARE

TRANSVERSE INERTIA= .0872 POUND INCH SQUARE

OUTER VOLUME= 2.3708 CUBIC INCHES

Figure D-2, continued. WEIGHT program output illustrating erroneous outer volume computation for model of figure D-1.

SAMPLE DECK NO.2 EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

WEIGHT CALCULATION REQUESTED
PLOT NOT REQUESTED
STABILITY CALCULATION NOT REQUESTED

1 BODY ITEMS

4 FINS

2 FIN PIECES

-0 KNOWN ITEMS

-0 OGIVES

1 COPIES OUTPUT REQUESTED

-0 DATA CHANGES

SAMPLE DECK NO.2 EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

INPUT DATA FOR BODY OF SHELL

NO.	IDENTIFICATION	D1	D2	LENGTH	DENSITY	REFERENCE
1	CYLINDER 1	1.0000	1.0000	2.0000	.1000	0.0000

INPUT DATA FOR FINS

4-FINS

NO.	IDENTIFICATION	R1	R2	LENGTH	DENSITY	REFERENCE	THICKNESS
1	FIN 1	1.0000	1.0000	2.0000	.1000	0.0000	.1000
2	-FIN 1	.5000	.5000	2.0000	-.1000	0.0000	.1000

Figure D-3. WEIGHT program output for model of figure D-1, using alternate approach to try and get correct outer volume.

SAMPLE DECK NO.2 EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

PROPERTIES OF BODY ITEMS

NO.	IDENTIFICATION	WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	CYLINDER 1	.1571	.0196	.0524	1.0000	1.5708

PROPERTIES OF FIN ITEMS

NO.	IDENTIFICATION	WEIGHT	POLAR I	TRANSVERSE I	CG TO REF	VOLUME
1	FIN 1	.0800	.0267	.0267	1.0000	.8000
2	-FIN 1	-.0400	-.0033	-.0133	1.0000	.4000

SAMPLE DECK NO.2 EXPLORING OUTER VOLUME COMPUTATION PROBLEMS

PROPERTIES OF ENTIRE SHELL

WEIGHT= .1971 POUNDS

CG TO REF= 1.0000 INCHES

POLAR INERTIA= .0430 POUND INCH SQUARE

TRANSVERSE INERTIA= .0872 POUND INCH SQUARE

OUTER VOLUME= 2.7708 CUBIC INCHES

Figure D-3, continued. WEIGHT program output for model of figure D-1, using alternate approach to try and get correct outer volume.

Volume of the cylinder, VC,

$$VC = \frac{\pi D^2 H}{4} = \frac{3.1416(1.0)^2(2.00)}{4} = 1.5708$$

Volume of four fins on outside of cylinder, VF,

$$VF = 4\ (\text{height})(\text{width})(\text{thickness}) = 4(.5)(2.)(.1) = .40$$

Total outside volume = VC + VF = 1.97

Thus if it is desired to use fins in part of an outer volume computation, the user should be sure to subtract the volume of the portion of all the fins subtended by outer body items from the computed total when using WEIGHT or PROMS.

This discussion is not intended in any way as a criticism of the WEIGHT program, but rather is presented only to caution the user against indiscriminant use of fin items in applications where outer volume is required, and to explain the rationale behind omitting fin items from PHASOR automatic outer volume computations.

APPENDIX E

SIGN CONVENTIONS FOR "RAD" ON OGIVES

This section discusses the sign convention used in PHASOR for drawing ogives. Two separate methods are available for drawing ogives, the "WEIGHT" method and the "PHASOR" method. Each of these has a sign convention and will be dealt with in turn.

WEIGHT format ogive sign convention:

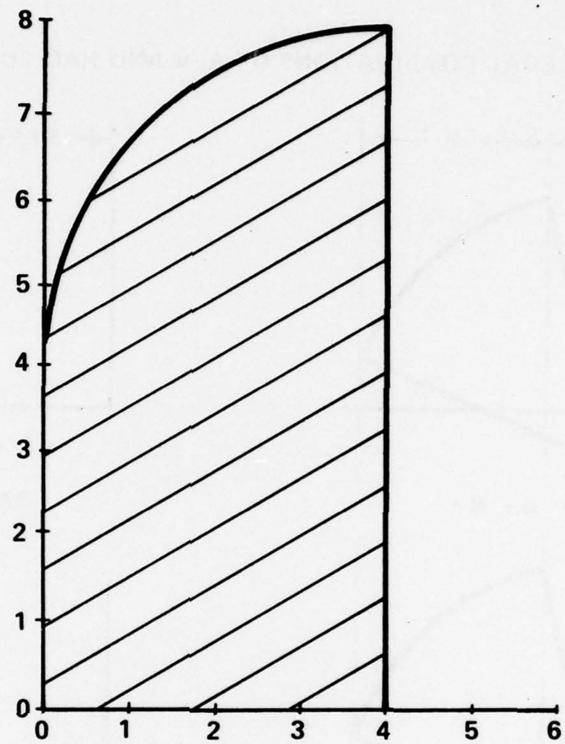
The WEIGHT program does not have a sign convention for RAD. That is, RAD must be positive. Unfortunately, this can lead to some difficulty in defining fillets using ogive descriptors, since there are six possible legal ogive "cases" and only four are defined. The other two combinations of "A", "B" and "RAD" are in "limbo".

Consider the following ogive description:

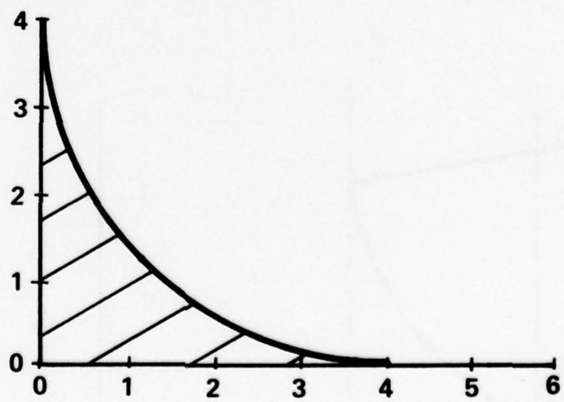
A=-4.0
B=-4.0
RHO=.1
REF=0.
RAD=4.

If you run this ogive description through the WEIGHT program and get a plot, it will look like figure E-1a.

However, figure E-1b has exactly the same description as figure E-1a, which means you can't draw the ogive for figure E-1b using the WEIGHT program.



a) "DRAWABLE" OGIVE FOR A=–4, B=–4, RAD=4



b) "UNDRAWABLE" OGIVE FOR A= –4, B= –4, RAD=4

Figure E-1. The WEIGHT program has no sign convention for RAD, making it impossible to model certain ogives.

LEGAL COMBINATIONS OF A, B AND RAD FOR PHASOR

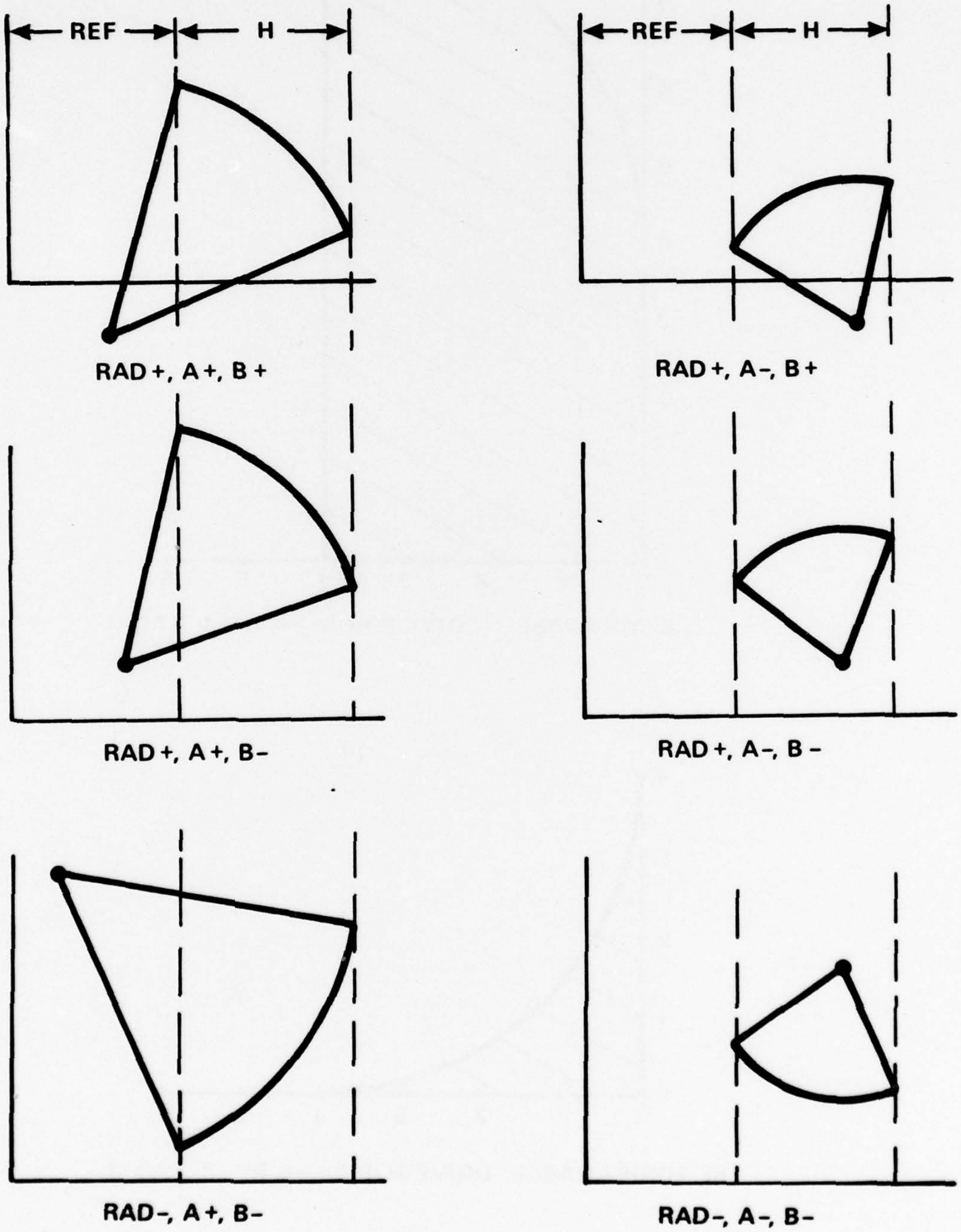
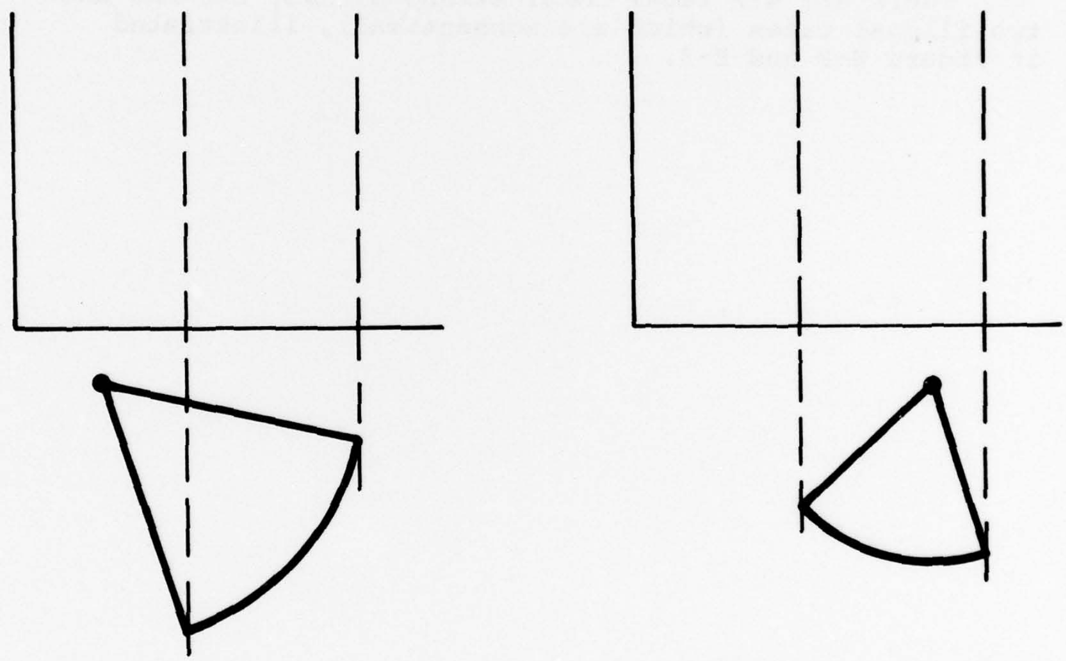


Figure E-2. PHASOR adopts a sign convention for RAD which permits generation of all possible ogives.

ILLEGAL COMBINATIONS OF RAD, A, AND B ARE DEFINED AS:



RAD-, A+, B+

RAD-, A-, B+

Figure E-3. "Nonsensical" ogives are illegal.

This problem can cause considerable difficulty when trying to describe "external" fillets. In order to alleviate this problem somewhat, a sign convention is defined for PHASOR for WEIGHT format ogives, so that "RAD" may be negative or positive. If "RAD" is specified as positive in the above example, the resulting ogive will appear as in figure E-1a. If RAD=-4, in the above example, the resulting ogive will appear as in figure E-1b.

There are six legal combinations of A,B, and RAD and two illegal cases (which are nonsensical), illustrated in figure E-2 and E-3.

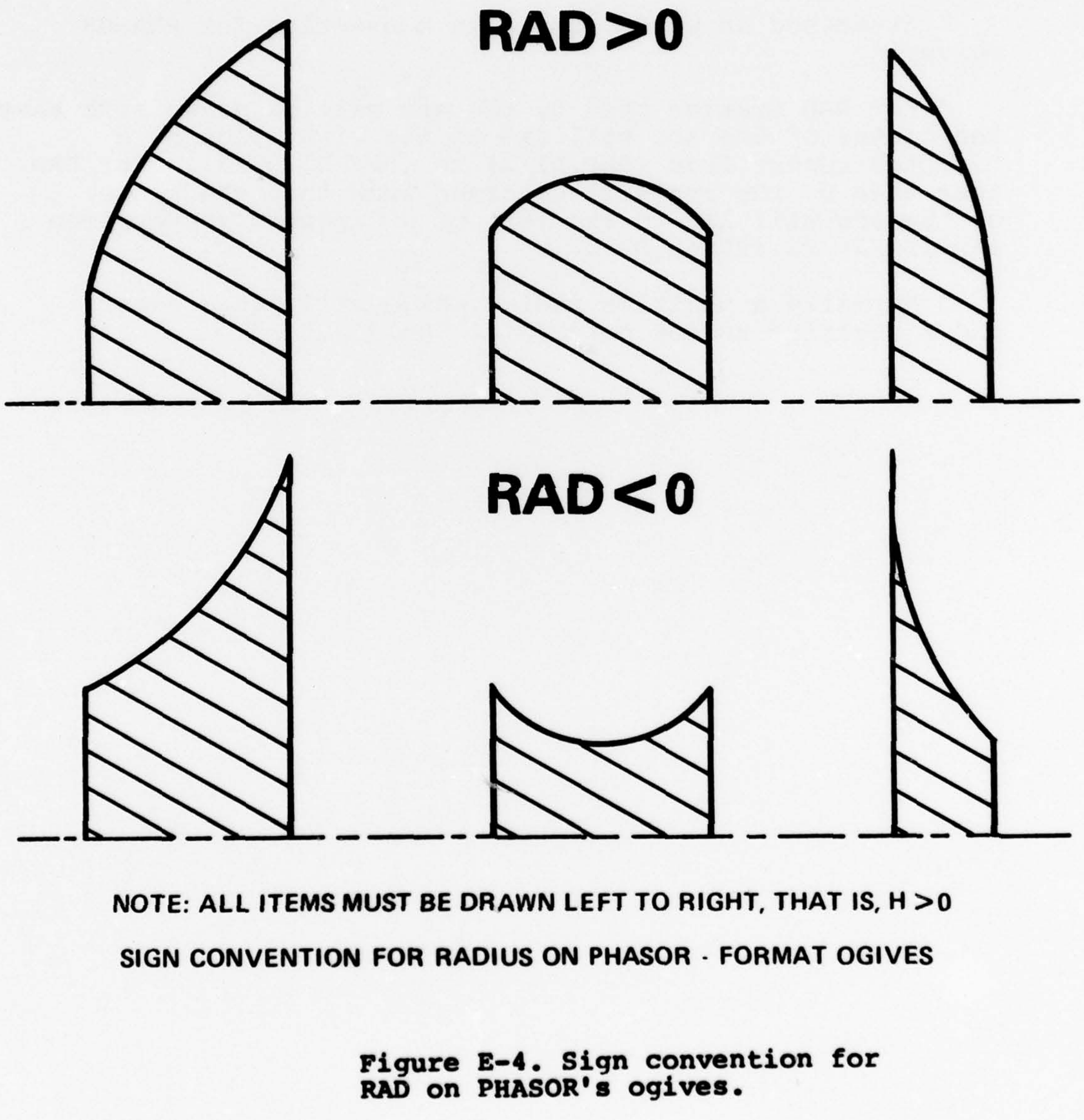
Sign convention of RAD on "PHASOR" format ogives

Let us now turn to the problem of sign on RAD for "PHASOR" format ogive construction. The sign convention is illustrated in figure E-4.

Expressed in words, the sign convention for PHASOR ogive is:

For RAD greater than 0, the arc will be drawn such that the center of the arc will lie to the right side of a directed vector from (REF,D1/2) to (REF+H, D2/2). For RAD less than 0, the arc will be drawn such that the center of the arc will lie to the left of a directed vector from (REF,D1/2) to (REF+H,D2/2).

Normally a positive radius ogive will "shed water", and a negative radius ogive will "hold water".



NOTE: ALL ITEMS MUST BE DRAWN LEFT TO RIGHT, THAT IS, H >0

SIGN CONVENTION FOR RADIUS ON PHASOR - FORMAT OGIVES

Figure E-4. Sign convention for RAD on PHASOR's ogives.

APPENDIX F

DERIVATION OF MATHEMATICAL FORMULAS

The equations used by PHASOR are developed in this section for reference. It should be noted that the equations for the properties of body and fin items are the same equations used by the WEIGHT program; however, the method used for computation of ogives is different, and the method for computing the total properties of the shell is slightly different, but mathematically equivalent.

Properties of body items:

The general case for body items is a truncated right circular cone. Referring to the figure observe that the volume of the body item, V, may be defined as

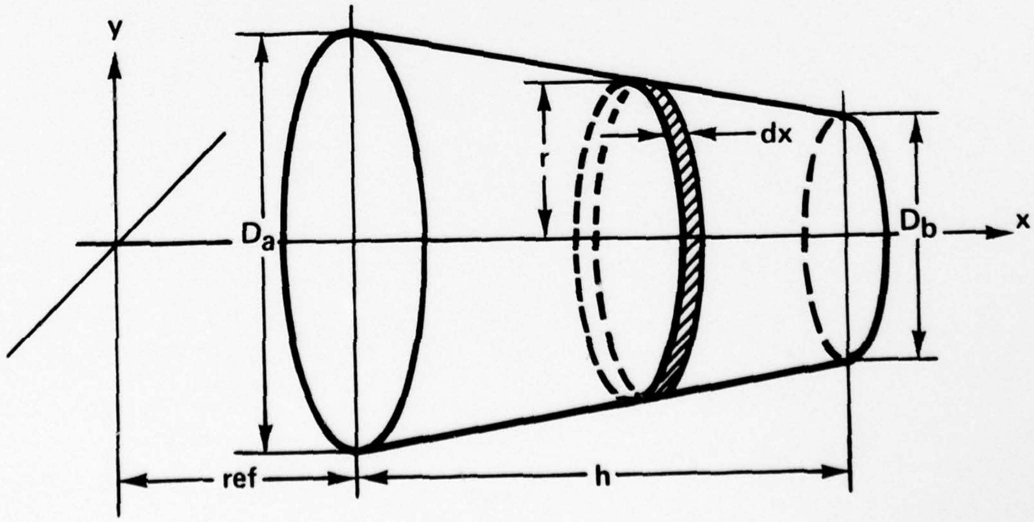
$$V = \int_a^b A(x)\,dx$$

WHERE,

$$A(x) = \pi[r(x)]^2 = \pi r^2$$

INTEGRATING,

$$V = \frac{\pi h}{12}\left(D_a^2 + D_a D_b + D_b^2\right)$$



The weight of the body item W, is

$$W = \rho V$$

The polar moment of inertia is defined as second moment with respect to the axis of symmetry:

$$P = \rho \iiint (y^2 + z^2)\, dx\ dy\ dz$$

$$= \frac{\pi h \rho}{160} (D_a{}^4 + D_a{}^3 D_b + D_a{}^2 D_b{}^2 + D_a D_b{}^3 + D_b{}^4)$$

The center of gravity, C of the body item is defined as

$$C = \frac{\pi h}{48V} (D_a{}^2 + 2D_a D_b + 3D_b{}^2)$$

The transverse moment of inertia about a plane passing through the C.G. of the body item, perpendicular to the longitudinal (x) axis, T', is given by:

$$T' = \frac{\pi h^3 \rho}{120} (D_a{}^2 + 3D_a D_b + 6D_b{}^2) - WC^2$$

Properties of fin items

Refer to figure F-2 which shows the general form of a fin item. It is a trapezoidal solid with bases Ra and Rb and height h. The volume of a fin item having N such fins around the circumference of the shell at equal angular distances is,

$$V = \frac{Nht}{2} (R_a + R_b)$$

and the weight is

$$W = \rho V$$

The Polar moment of inertia may be approximated for thin fins as

$$P = N \rho ht (R_a{}^3 + R_a{}^2 R_b + R_a R_b{}^2 + R_b{}^3)$$

The center of gravity will lie on the longitudinal axis of the shell provided 2 or more fins exist at equal angular distances around the circumference at the shell. The C.G. with reference to the left end of the fin is given by

$$C = \frac{h (R_a + 2R_b)}{3 (R_a + R_b)}$$

The average transverse moment of inertia of a fin item rotating about the longitudinal axis at uniform angular velocity for one revolution is given about a plane perpendicular to the longituinal axis and passing through the c.g. as:

$$T' = \frac{Nth^3}{12} (R_a + 3R_b) - WC^2$$

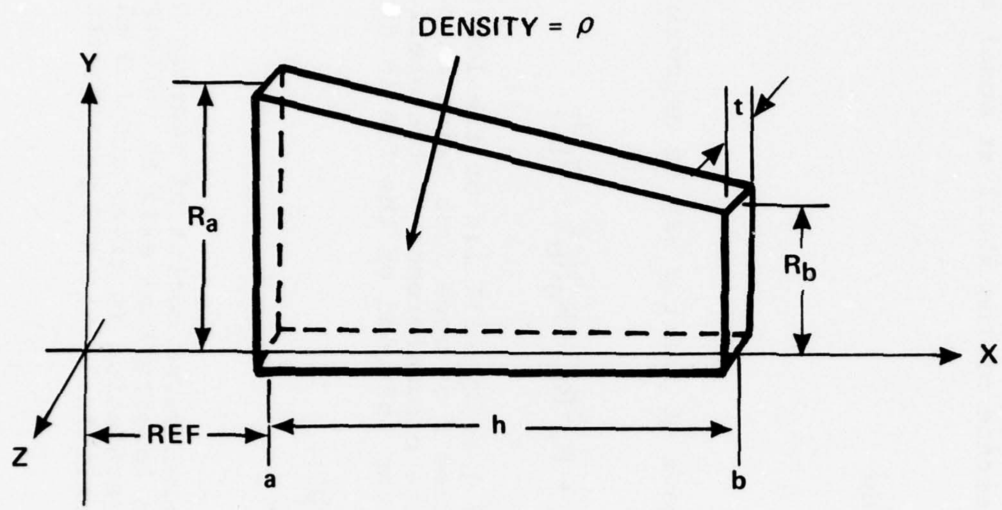


Figure F-1. Nomenclature for fin formula derivations.

Properties of ogival items

The calculation of the properties of ogival items is not readily amenable to direct solution because the derived formulas depend heavily on the difference of products of large numbers. In order to achieve reasonable results, greater precision arithmetic would be required than is available on the CDC computer using standard single or double precision arithmetic. Instead, an approximation technique produces more reasonable results by breaking each ogive up into into 100 body items and summing the results. However, PHASOR does not break up the ogive in the same manner as the WEIGHT program. The differences are illustrated in figure F-3 for a simplified ogive broken up into only four parts.

In figure F-3a, the method used in the WEIGHT program is illustrated. Here, the ogive is broken up into body items having equal lenghts along the X axis, Δx.

In figure F-3b, the method used by PHASOR is illustrated. Here, the ogive is broken up into body items of variable length along the x axis but equal angular measure from the center of the ogive. The reason this method is employed is that it produces substantially less error in the approximation. The error is illustrated graphically as the shaded area between the ogive curve and the approximating body items (chords). As can be seen, the shaded area of the WEIGHT figure is considerably larger than for PHASOR. Naturally, the actual error is much smaller than that illustrated because 100 approximating body items are used instead of the four illustrated. However, actual benchmark tests have shown that the error in ogive computations for hemispheres may exceed one percent for the WEIGHT, but are limited to about .2 percent for PHASOR for the same ogives.

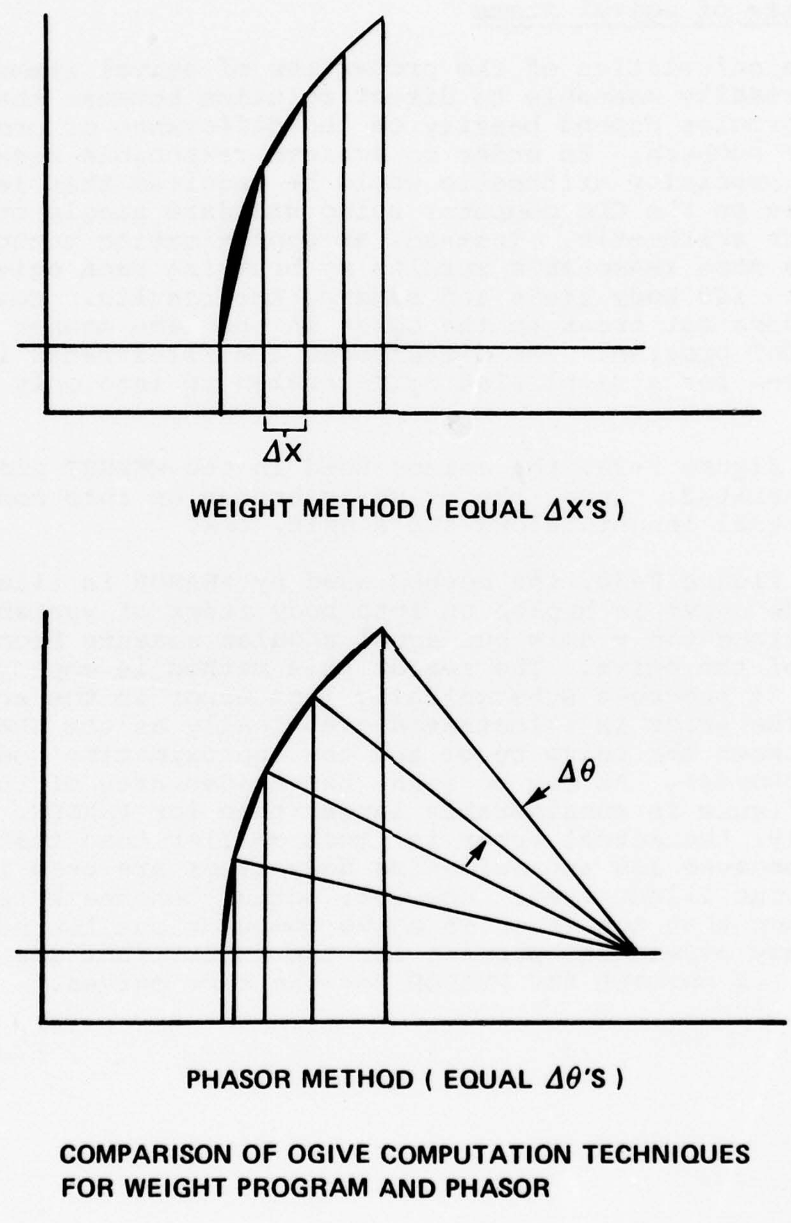


Figure F-2. Approximation techniques used by WEIGHT and PHASOR programs for ogive computations.

Properties of the entire shell

Once the individual properties of all items have been computed, the properties of the entire shell may be computed. If we denote the properties of the ith item by the subscrpt i, the total properties of the shell may be defined by the following equations:

TOTAL VOLUME

$$V_T = \sum_{i=1}^{n} V_i$$

TOTAL WEIGHT:

$$W_T = \sum_{i=1}^{n} W_i$$

TOTAL C.G. WITH RESPECT TO ORIGIN

$$C_T = \frac{\sum_{i=1}^{n} (W_i\, C_i)}{W_T}$$

TOTAL POLAR INERTIA:

$$P_T = \sum_{i=1}^{n} P_i$$

TOTAL TRANSVERSE INERTIA ABOUT A PLANE PERPENDICULAR TO LONGITUDINAL AXIS PASSING THROUGH CT:

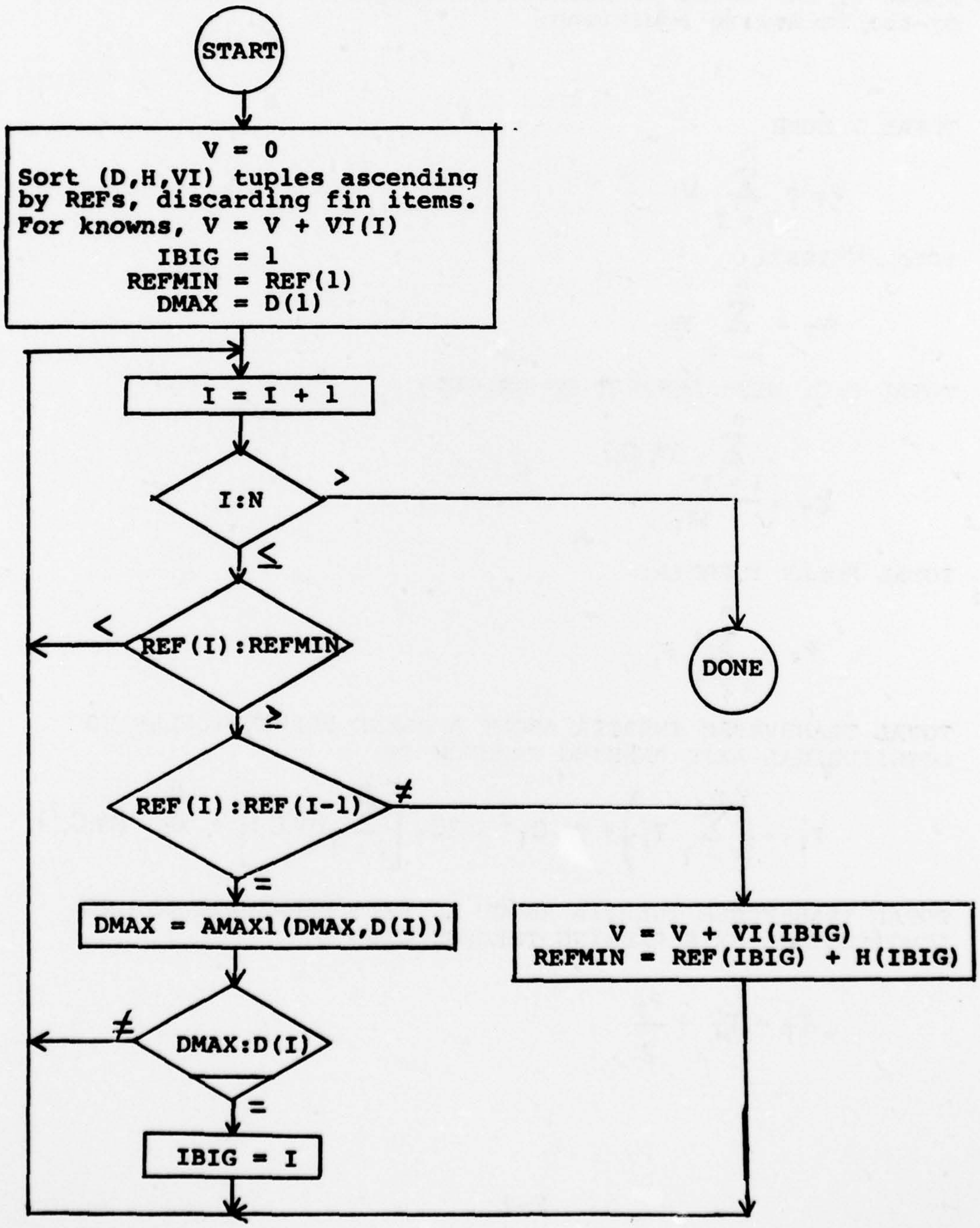
$$T'_T = \left(\sum_{i=1}^{n} T'_i\right) + W_T C_T{}^2 - 2C_T\left[\sum_{i=1}^{n} (W_i C_i)\right] + \sum_{i=1}^{n} (W_i C_i{}^2)$$

TOTAL TRANSVERSE INERTIA ABOUT AN AXIS PERPENDICULAR TO LONGITUDINAL AXIS PASSING THROUGH CT:

$$T_T = T'_T + \frac{P_T}{2}$$

FLOWCHART FOR AUTOMATIC OUTER VOLUME ALGORITHM

Definitions: V = Total volume of shell; to be computed.
D(I) = Diam. of left end of Ith item.
H(I) = Length of Ith item.
REF(I) = Reference distance of Ith item.
VI(I) = Volume of Ith item.
N = Total number of items, excluding fins.



APPENDIX G

Reserved File Names

The following local file names are reserved for use by PHASOR and should not be used for user data files except as noted in the text:

OUTPUT	TAPE58	TAPE59	TAPE60
TAPE61	TAPE62	VEDIT	TAPE6
SOS			

APPENDIX H

4800 BAUD SYNCHRONOUS OPERATION

Throughout this manual, use of a standard 300 baud modem with asynchronous ASCII character transmission has been assumed. Users with access to 4014 terminals equipped with Tektronix option 20 CDC synchronous interfaces and 4800 bps modems may use this equipment instead. Select "4800" and "BCD" on the rear interface panel. Set the "CODE EXPANDER" rocker switch on the keyboard to "ON". While the "LINE/LOCAL" rocker switch is in the "LINE" position, depress "SHIFT" and "RESET". Dial up a 4800 baud port and LOGIN normally. Then start PHASOR as follows:

COMMAND - <u>ETL,100.</u>

COMMAND - <u>BEGIN, PHASOR, BR/CARBREY,BAUD=4800</u>

A word of caution: Due to idiosyncrasies of the option 20 interface hardware, not all aspects of 4800 baud PHASOR will duplicate 300 baud operation. In particular, tablet mode operation is not recommended when using option 20 in 4800 baud mode. In addition, certain information may not appear at the "proper" place on the screen, which is a minor nuisance, but will not effect the results. For more information, contact Bruce Carbrey at Autovon 880-4364.

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1. Control Data Corporation, SCOPE REFERENCE MANUAL, Publication No. 60307200.

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6. Rosa, Sam, A Shell Computer Program Users Handbook, TSD, Picatinny Arsenal, Dover, N.J.

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7. AUTHOR(s) Bruce D. Carbrey		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Management Information Systems Directorate ARRADCOM, Dover, NJ 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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PHASOR	Weight	Moments	Axisymmetric	Projectile Polar
Properties	Ballistic	Shell	PROMS	Inertia
TEKTRONIX	C.G.	DAGMAR	WEIGHT	Transverse

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

PHASOR (PHysical Analysis of Solids of Revolution is a large interactive graphics computer program for computing the weight, center of gravity, volume, and moments of inertia of axisymmetric bodies such as projectiles, rockets, bombs, etc. A Tektronix 4014 graphic terminal is required to run PHASOR on the CDC 6500/6600 computer at ARRADCOM, Dover, N.J. The program includes many flexible capabilities, including file generation/

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